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The Secret of Those Curly Locks

Science steps in and waves
the straightest hair

FOR years and years, probably ever since Eve's day, seductive woman has tried to fulfill man's idea of loveliness. Does he admire blondes? Forthwith the peroxide bottle appears. Does he prefer curly hair? The dear ladies undergo tortures in sleeping on lumpy curl-papers, and burn off enough hair with hot irons to supply the armies of the world with mattresses. Every drug store is a beauty shop, crammed with numberless lotions, ointments, freckle removers and skin foods, all to be applied in the endeavor to please man's critical eye.

Man has watched this struggle of woman throughout the ages. When he found he couldn't bear the spectacle any longer, he gallantly came to her relief. It is he who invents and manufactures all the wrinkle-removers, chin-straps, hair-trainers, and lip sticks. Even science takes a hand in the game. Step right up ladies. Give two hours of your precious time to the scientific beautifier. Fido can get on without you for that long and the great bargain in yon shop will be there two hours hence; so step right up and change yourself into a Mary Pickford.

Your hair is straight, and you want it waved—permanently? Walk into this little room. It is spotless white and gleaming gold, quite to your feminine taste. What are they doing now? Just tying a rubber mat in back of your head. Why are they swathing you in sheets? To protect your clothes. Next, they take down your hair, and you lean back luxuriously, your head over a basin, while your hair is given a thorough shampoo. What dries it so quickly? Electricity, my dear.

"Please walk in here," says the scientific hair man. It is another little room. Above your head is something that looks like a huge, old-fashioned chandelier. Only instead of lights, about fifty little round devices that look like sockets for electric lights hang on long, pendulous green cords.

You are seated directly beneath this device. Quick, deft fingers dampen your hair with a solution. But what's this? Oh, he's wrapping it around small, hollow pieces of metal. They are curlers about a quarter of an inch in diameter and about four inches in length. Each curler is fastened in one of the pendent sockets. The current is turned on.

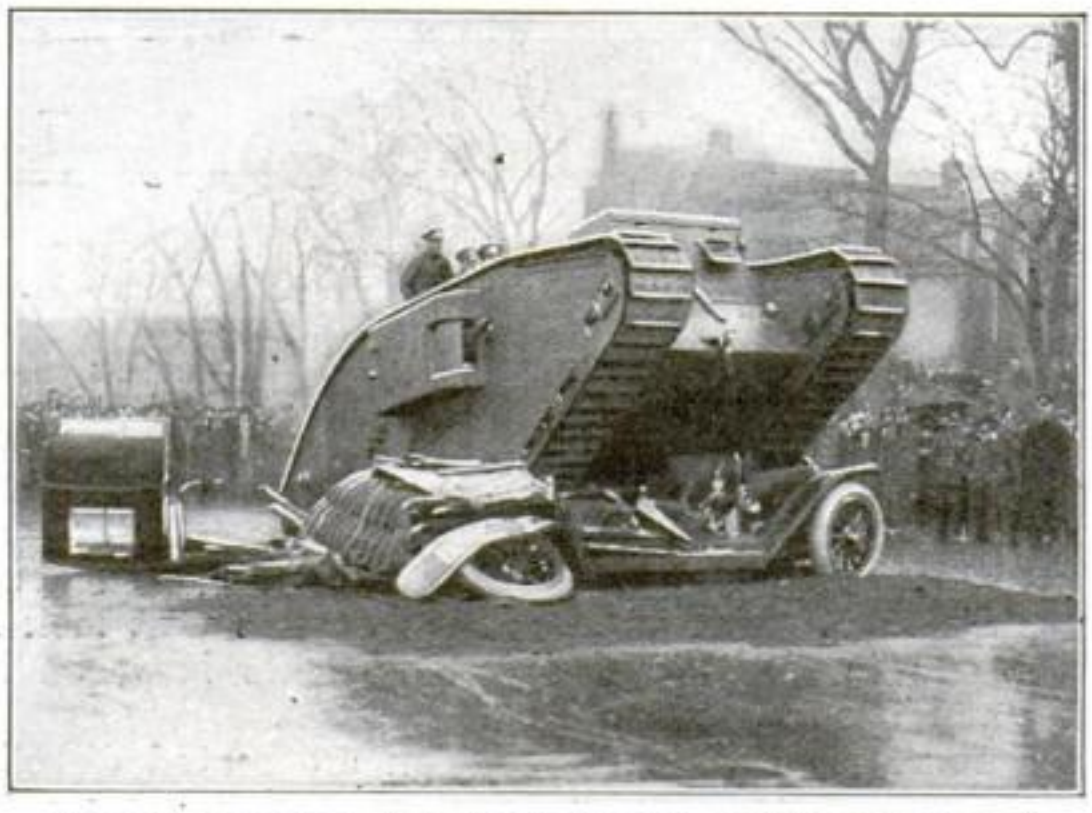
For ten minutes you sit breathlessly awaiting the miracle. The current is turned off. The baking process is over. They wash your hair and dry it again. Now look in the mirror. Your astonished and delighted eyes behold a perfect riot of curls where straight wisps disgusted you but a short time ago. But that's not all.

Man has done much for woman, but he hasn't been able to make her hair grow in curly. Perhaps he will, by and by, who knows? In the meantime, your hair will grow, and if you want those curls to start in right at the root of your hair, you have to have the new hair curled once every six months. The long hair that was first curled will retain its curl to the end of time.

When the permanent wave was first invented, the process was much more troublesome than it now is. It used to take nearly all day to do the trick, but to-day it is possible to have the whole thing over and done with in two hours.

Butchering an Automobile to Make a Tank Holiday

WE have been hearing for months of the terrible destructive power of those new Goliath's of war, the British tanks. In motion pictures we have seen them amble along in and out of great shell holes, crawling over trees and barbed-wire entanglements and crushing everything beneath them. It would seem as if we were a tankwise people. Not so, however, with the Canadians. Like the Missourians, the Canadians had to be "shown" to be convinced. In other words, the army authorities in Toronto, Canada, had to run a tank over a perfectly good automobile to prove that it was capable of destroying something.



Toronto watched and laughed while a big monster of a tank ran over an automobile. You can see the result

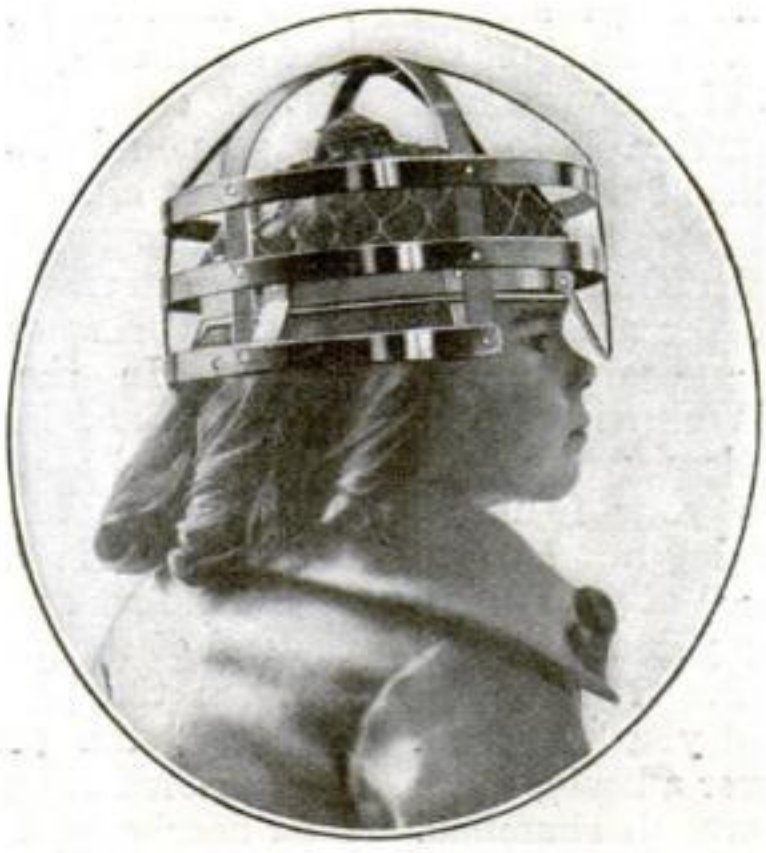
The accompanying illustration shows that the tank did its work well. The automobile—a limousine—was placed in the street on a thin sprinkling of earth. The tank approached, crushed the rear part of the machine to bits and then returned and ran over the front portion. Even the tires, which appear to be new ones, were not spared in the general wreck. We have several friends who would have taken good care of that poor, helpless automobile.

They Can Always Borrow a Few Fine Names from the Patent Medicines

FINDING names for newly discovered asteroids, or minor planets, is getting to be as difficult a problem as naming the Pullman cars. The names of heathen divinities were all used up long ago. Among the more outlandish names now found on the list are: Ottegebe, Dudu, Juewa, Abnoba, Libussa, Ilmatar, Aaltje and Siegena.

Can the Little Lady Now Bump Her Head? She Cannot

A LITTLE girl, sixteen months old, just learning to walk, toddled to the edge of her home porch one day—unseen. She dived from the veranda to the concrete pavement which was six feet below.



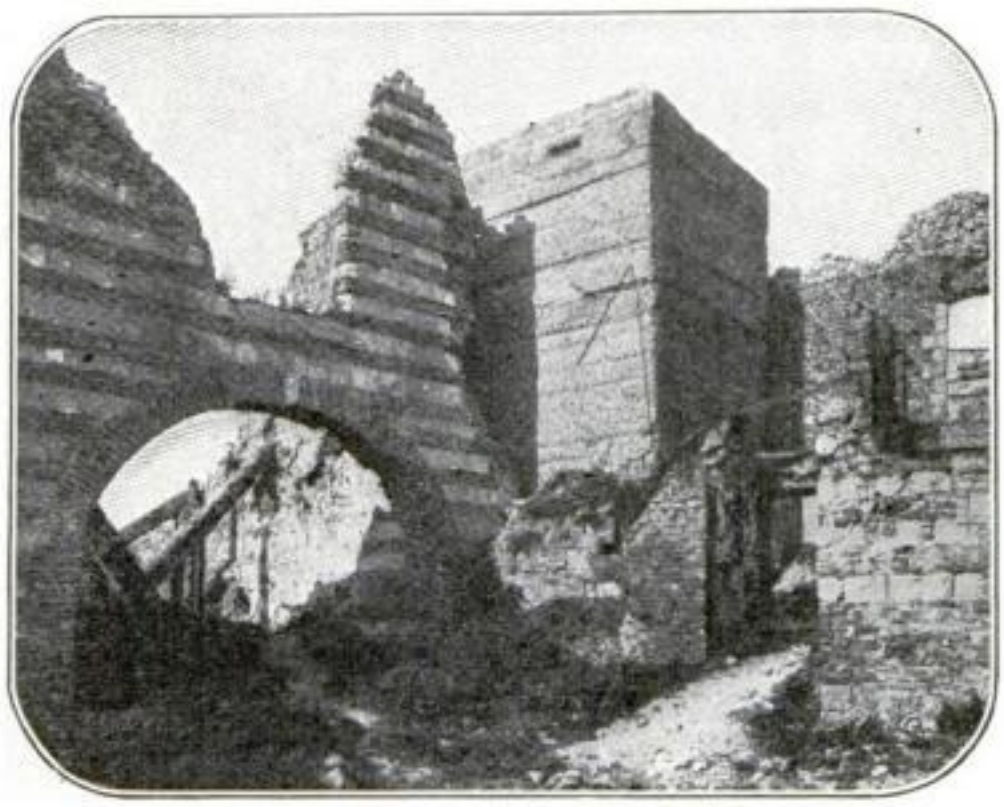
With a pillow strapped to her back and this guard on her head, the young lady should be ready for all bumps

Her father, hoping to prevent similar accidents, invented the protective helmet here shown. The total weight is only six ounces in the small size. A cloth inner cap and a padded band make it so comfortable that a child forgets in five minutes that it is wearing anything unusual.

Larger sizes and different patterns are made to meet the requirements of industrial workers who need head guards.

Can You Tell Which Part of These Ruins Is Camouflage?

THE French invented the word camouflage, but the Germans are fast becoming past masters of the art—as witness the accompanying photograph. Between two shell battered walls of the church at Moncy-aux-Bois they built a concrete observation tower with slits for machine gun operations. So cleverly colored and arranged to fit the general landscape was this little addition, that from a distance it looked like a part of the original ruin.



French Official Photo

A cleverly camouflaged observation tower which contains slits for maneuvering real machine guns

Let the Flames Roar. He Wears an Asbestos Suit

A FIRE-FIGHTING suit of asbestos cloth is one of the latest and most useful of the many practical applications of this remarkable mineral substance. The long, gossamer shreds of the snowy-white mineral, soft as thistle-down, are woven into a firm, heavy cloth which can be used for gloves, coats, trousers and leggings. Such clothes would be a protection to firemen and workmen about electric furnaces, blast furances, glass plants and wherever else high temperatures must be encountered.

The well known heat resisting properties of asbestos, together with the fact that, unlike any other mineral, it will cleave into fiber, delicate as flax, make it the one substance in all nature ideally adapted to such a purpose.

The long, gossamer shreds of the snowy-white mineral, soft as thistle-down, can be woven into firm, heavy cloth

Here's a New Cutting Steel

WORD has come that is of much interest to American mechanics. The English have recently invented a strong and superior high-speed steel. Such news to the layman may mean little. But to those who know, it is as welcome as the news of a great land victory. Why? Because that side which can turn out war machinery the fastest will win the war!

With this new tool steel—"colbaltcrom," it is called—engines and guns can be worked faster with out the added heat that develops and affects hardness and rigidity.

Tools of this steel can be cast into shape, and casting is the quickest known way of making any tool. There are few steels, however, which by casting them do not become brittle. "Colbaltcrom steel," nevertheless, can be made in this manner instead of having to be forged and rolled, two very much lengthier and more expensive processes.

Let the Sausage Balloon Speak to You on the Screen

SCENE: Palm Beach, Florida. Artemus is observed employing every known photo-play gesture to express his infatuation for Viola Dewdrop. It's plain that he is desperately in love. You know he is talking, for you can see his lips move. Viola Dewdrop seems dramatically happy.

Do you want this beautiful, heart-gripping picture of human interest suddenly cut off, and the usual, cold, distracting, explanatory type matter flashed in its place? Certainly not! So here is a suggested improvement.

The picture remains on the screen. Suddenly Artie's cheeks puff out and he blows squarely into Viola's face. If you have never before witnessed this type of photo-play you may think that Artie is trying to blow the powder from Viola's nose. That is not so. Somewhere in the cavity of one of his teeth, Artie has been concealing a rubber balloon. He has suddenly grasped the open end of the balloon between his lips and as he blows, the balloon is inflated until it assumes the form of an over-sized sausage. Upon this balloon appears in plain words, exactly what Artie is saying. Is this not a marvelous idea?

The mystery is all cleared up now. Artie says "I adore you." Now it is Viola's turn to blow. On her rubber sausage appears the words "What will the neighbors say?" Meanwhile Artie's inflated balloon shrivels up. Another which was secreted in a cavity in his wisdom tooth takes its place. This one says, "We'll move to Barren Island where there are no neighbors," and so on.

Upon the sausage-shaped balloons appear what these motion-picture actors are supposed to be saying

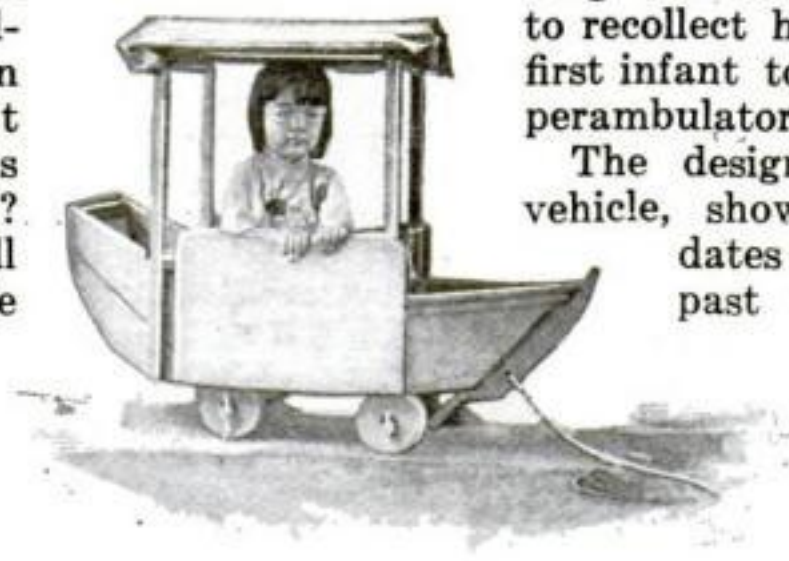
In order to produce a photo-play of this type successfully, we believe it will be necessary to employ players with plenty of teeth. Each tooth will have to be carefully hollowed out by an expert dentist to provide for storage of the various visible speech-balloons. With a little practice and patience, the player will have no difficulty in locating with his tongue the particular balloon required. Temperamental and impulsive artists must be careful lest they blow too hard and burst their words.

Last September, Charles F. Pidgin proudly patented this inflatable speech-sausage. Congratulations, Charles!

The Original Model for All Baby Carriages Comes from China

A LITTLE Chinese baby, who has been an ancestor now almost too long for even a Chinese memory to recollect him, may have been the first infant to be rolled out in a real perambulator.

The design for the queer little vehicle, shown in the illustration, dates back into such a dim past that Confucius himself is credited with its invention in a benignant moment. It's resemblance to a Noak's Ark also speaks for its exceedingly ancient origin.



An antique Chinese perambulator. A primitive canopy shields the baby from the sun

Let This New Chair Add to Your Bathing Convenience

MR. FRANK BEHM, of Toledo, Ohio, has invented an adjustable chair for the bathtub. As the accompanying cut shows, it can be hooked on the end of the tub, the user reclining somewhat at ease, above tide level, while he performs his ablutions at leisure.

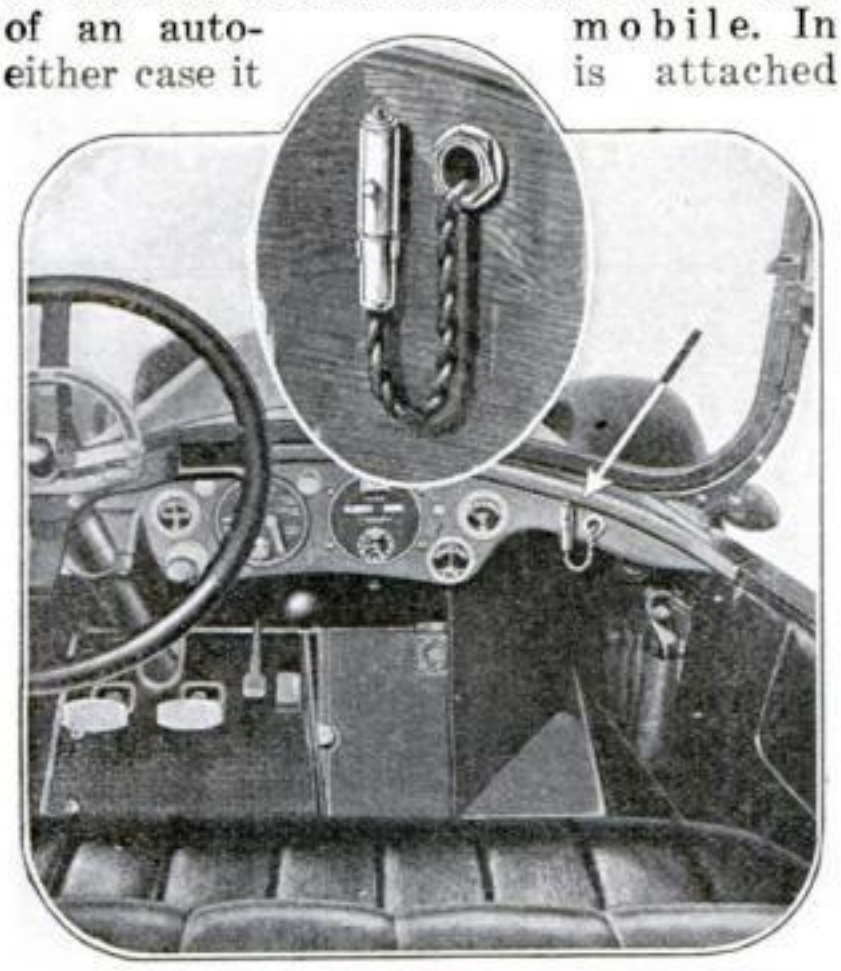
But the use of this appurtenance is not necessarily confined to the bath. Hooked on the rail of the back piazza it would do for a small-tub stand while washing out baby's stockings. Attached to a rail fence at a Sunday School picnic it might save the lunch from the ants.

This legless chair hooks over the edge of the tub

A New Automobile Cigar-Lighter

THE new type of electric cigar-lighter shown in the accompanying illustration is designed to be mounted either on the dash or on the rear of the front seat of an automobile. In either case it is attached to a cord which is automatically wound up on a reel, enclosed in a case which forms the back of the plate on which the cigar-lighter is held.

The lighter is prevented from rattling while the car is in motion by means of a small spring-clip attached to the face plate of the mounting. Current is obtained from the battery in the car.



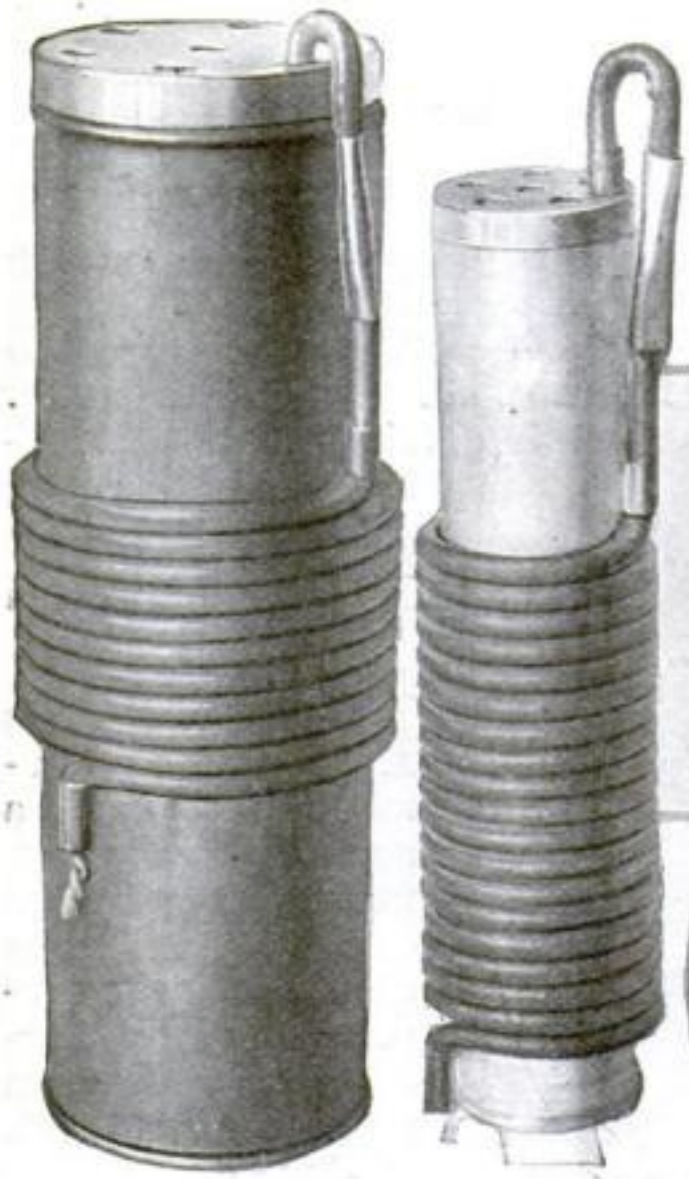
A reel in the rear of the case winds up the cord when the cigar-lighter is not in use

The Germs in a Swimming Pool

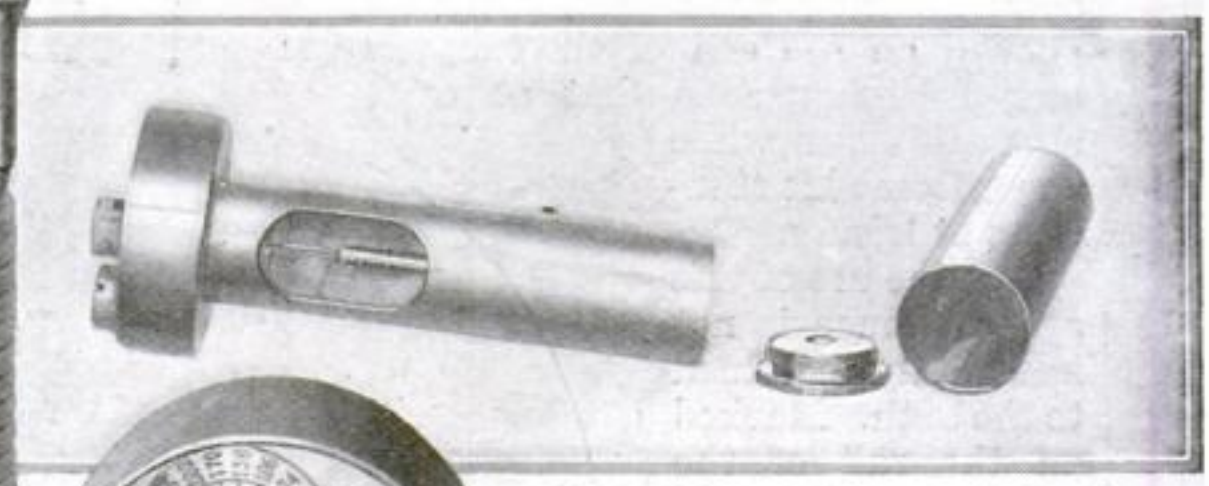
PUBLIC baths and swimming pools are a source of both benefit and pleasure to a community, but they are exceedingly dangerous to health unless they are kept in a sanitary condition. Water which has been contaminated by sewage is always unsafe for bathing purposes. Another source of contamination is from the bathers themselves. The water of a Liverpool bath was examined to determine how much the bathers contaminated it. It was found that each bather contributed about 4,000,000 germs to the water of the swimming pool in ten minutes. In the second-class baths which are patronized by small boys, it was found that each bather added 6,000,000,000 germs to the pool during a similar period. At the end of the day, the water held no less than 4,676 germs per cubic centimeter.

The germs which are a danger to health are those of intestinal origin. The presence of other bacteria does not make the swimming pool unsafe. If the water is treated with chloride of lime it can be rendered perfectly sterile. When certain precautions are taken and the bathers themselves instructed in the rudiments of personal cleanliness, there is no reason public swimming pools should not be of great benefit to a crowded community, especially during the uncomfortably hot summer months when cool baths do so much to make the heat bearable.

Have You Wondered Why So Many Fires and Explosions Occur These Days? Here Are a Few of the Reasons

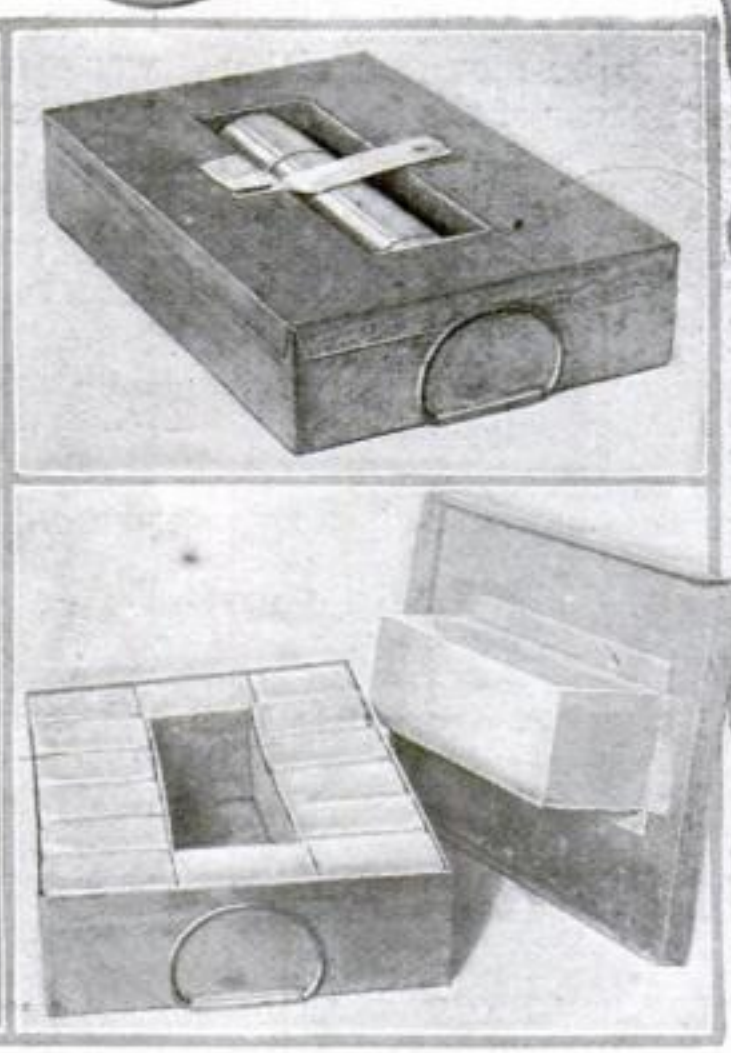


These choice gems are made of tin and contain thermite, a priming composition, and a time fuse. The heat of the thermite easily starts fires

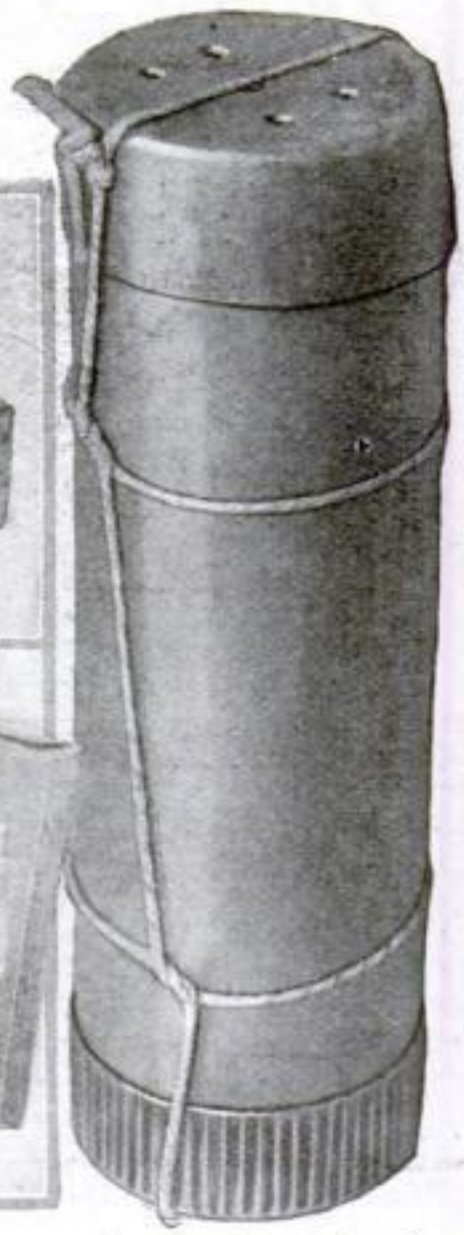


Norwegian police seized the bombs shown on these pages from German couriers. Were they en route to this country? German agents do not tell too much. Above is a chemical detonator; at left, a mechanical one with clock. Both are deadly

They carried them around beneath coats, and in suitcases



The interior of a coat parcel. Look out for the central cylinder!

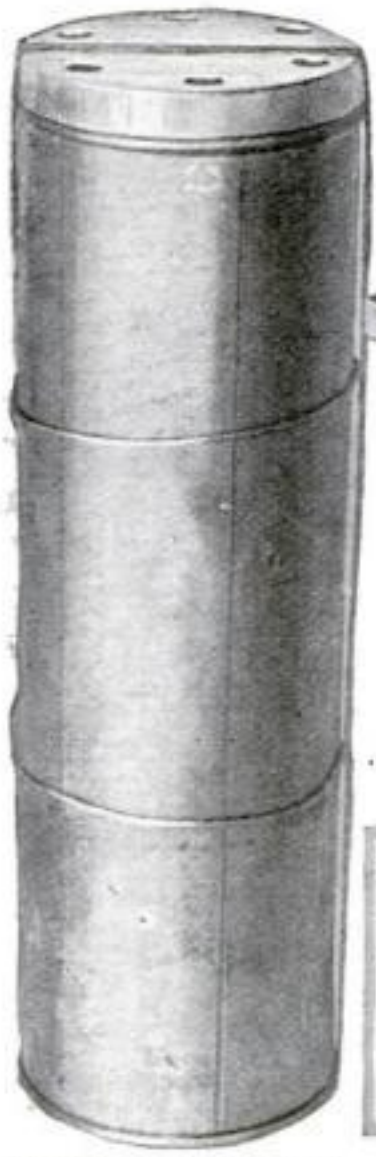


A nine-foot bomb filled with thermite

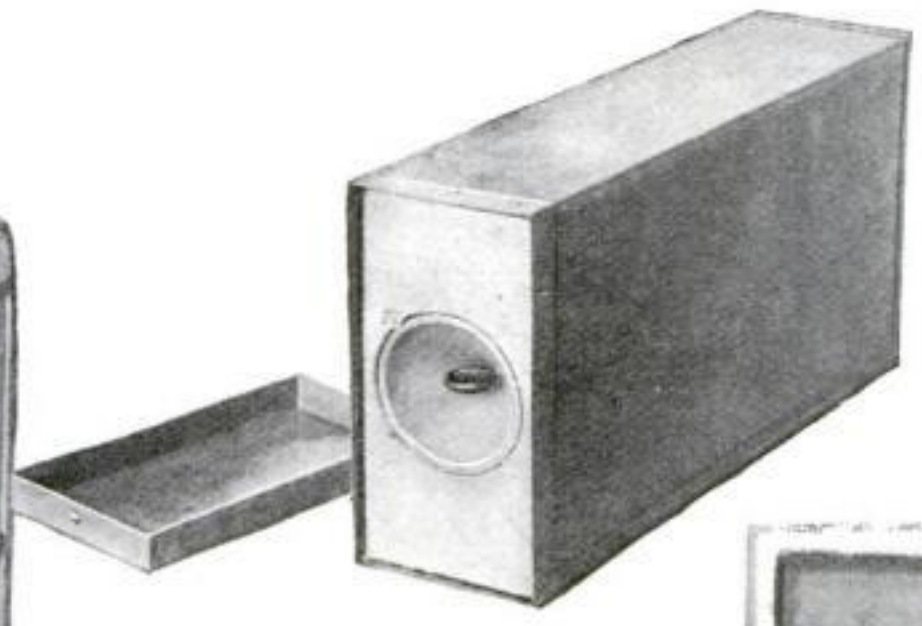
It's Bombs Such as These That the Kaiser's Agents Have Been Using to Blow Up Our Factories and Ships

Papier-maché bomb made to resemble coal and filled with exceedingly high explosive

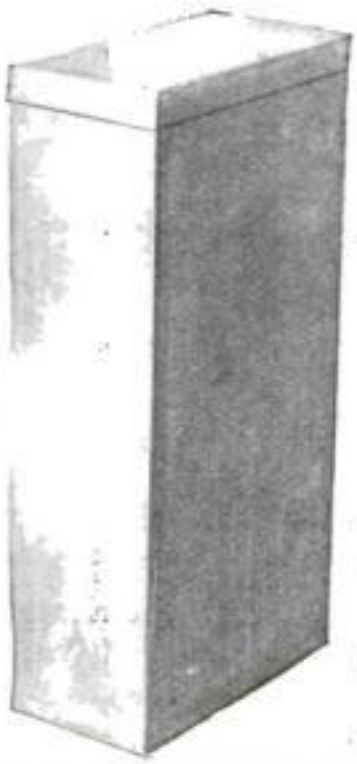
Throw the coal bomb in a ship's furnace and then—Look Out!



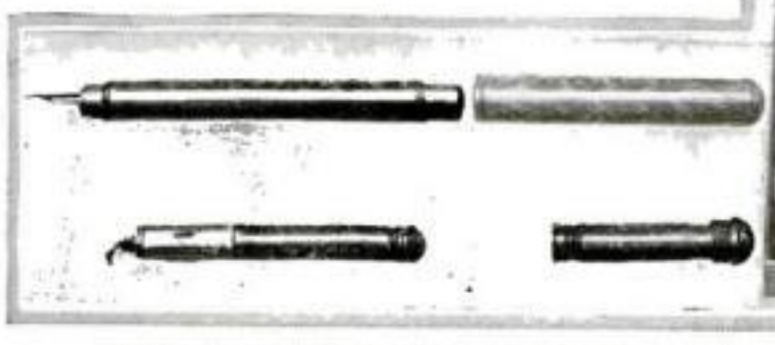
Another of the tall thermite bombs



In center of bomb is space for ignition mechanism and detonator. The rest is trinitrotoluol and fiendishness. Many such are made



These bottles are full of a powerful acid to eat off detonator wires

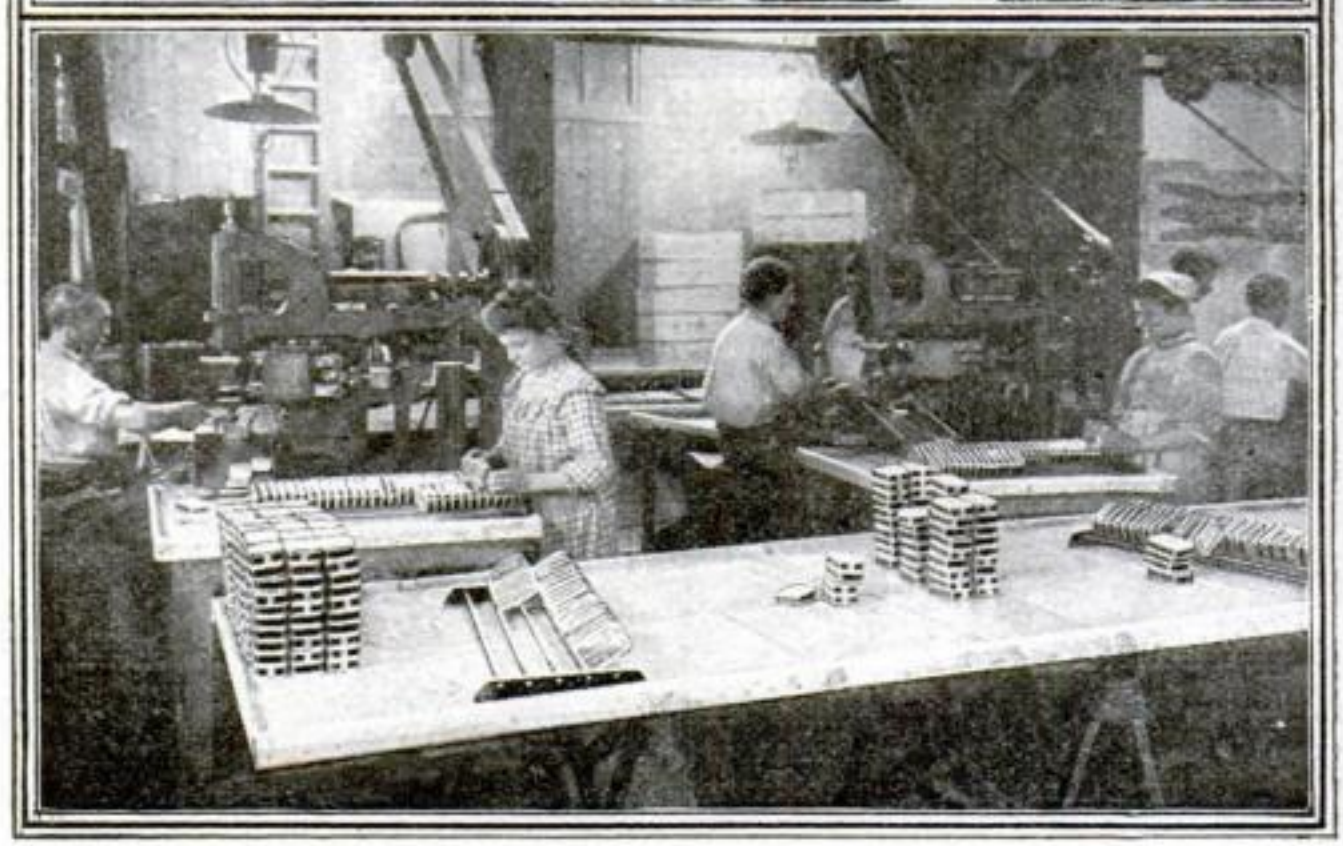


Fountain containing batteries, a detonator, and high explosives

Sardines Mean Wealth to Bretons

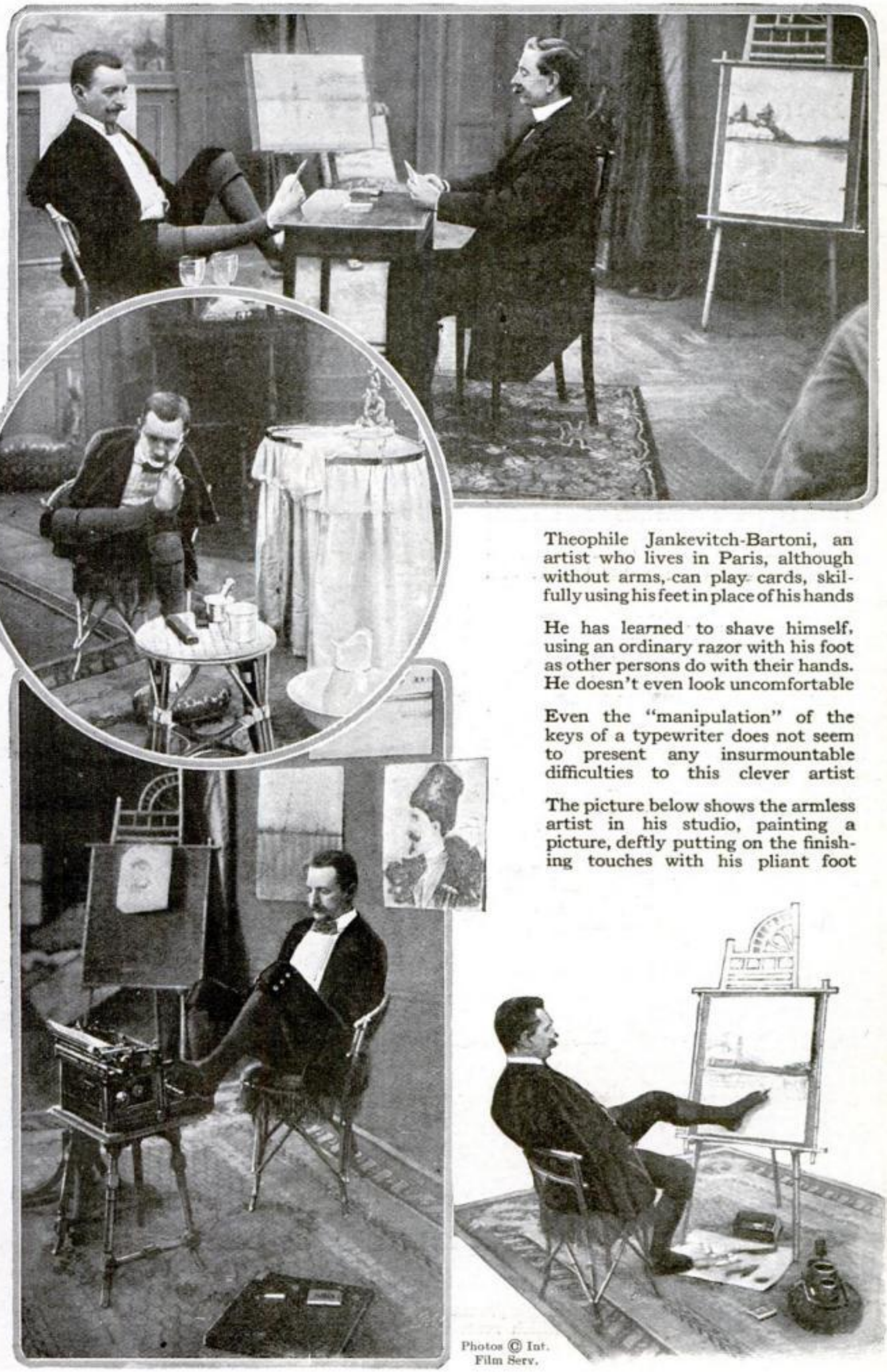
Trimming the sardines, by cutting off their heads and tails is the first step in preparing them for high-grade canning

Here the cans, already packed with fish, are filled with oil from the big tank shown in the foreground



The final steps in the canning process are the sealing of the packed cans and the printing of the ornate labels

Armless, But Not Helpless



Theophile Jankevitch-Bartoni, an artist who lives in Paris, although without arms, can play cards, skilfully using his feet in place of his hands

He has learned to shave himself, using an ordinary razor with his foot as other persons do with their hands. He doesn't even look uncomfortable

Even the "manipulation" of the keys of a typewriter does not seem to present any insurmountable difficulties to this clever artist

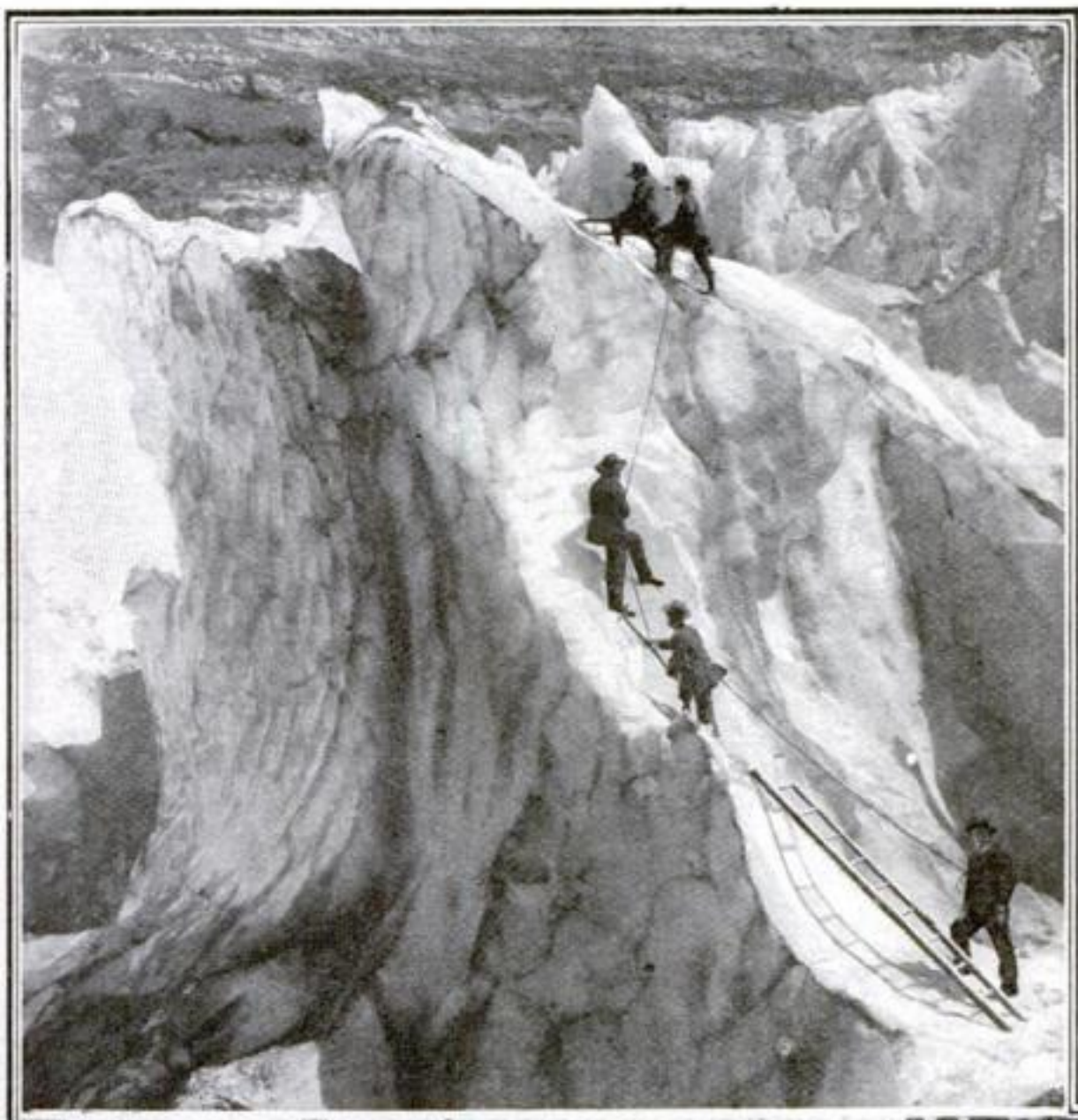
The picture below shows the armless artist in his studio, painting a picture, deftly putting on the finishing touches with his pliant foot

Photos © Int. Film Serv.

Bearding the Ice Giant in His Lair—The Glory of Mountaineering in the Alps

Only those who have tried it and who have met with success can ever understand and fully appreciate the fascination of mountaineering in the high Alps. The greater the difficulties and obstacles, the more serious the risks of the ascension, the more genuine pleasure does the true mountain tourist derive from his hazardous undertaking, which is a pleasure trip to him

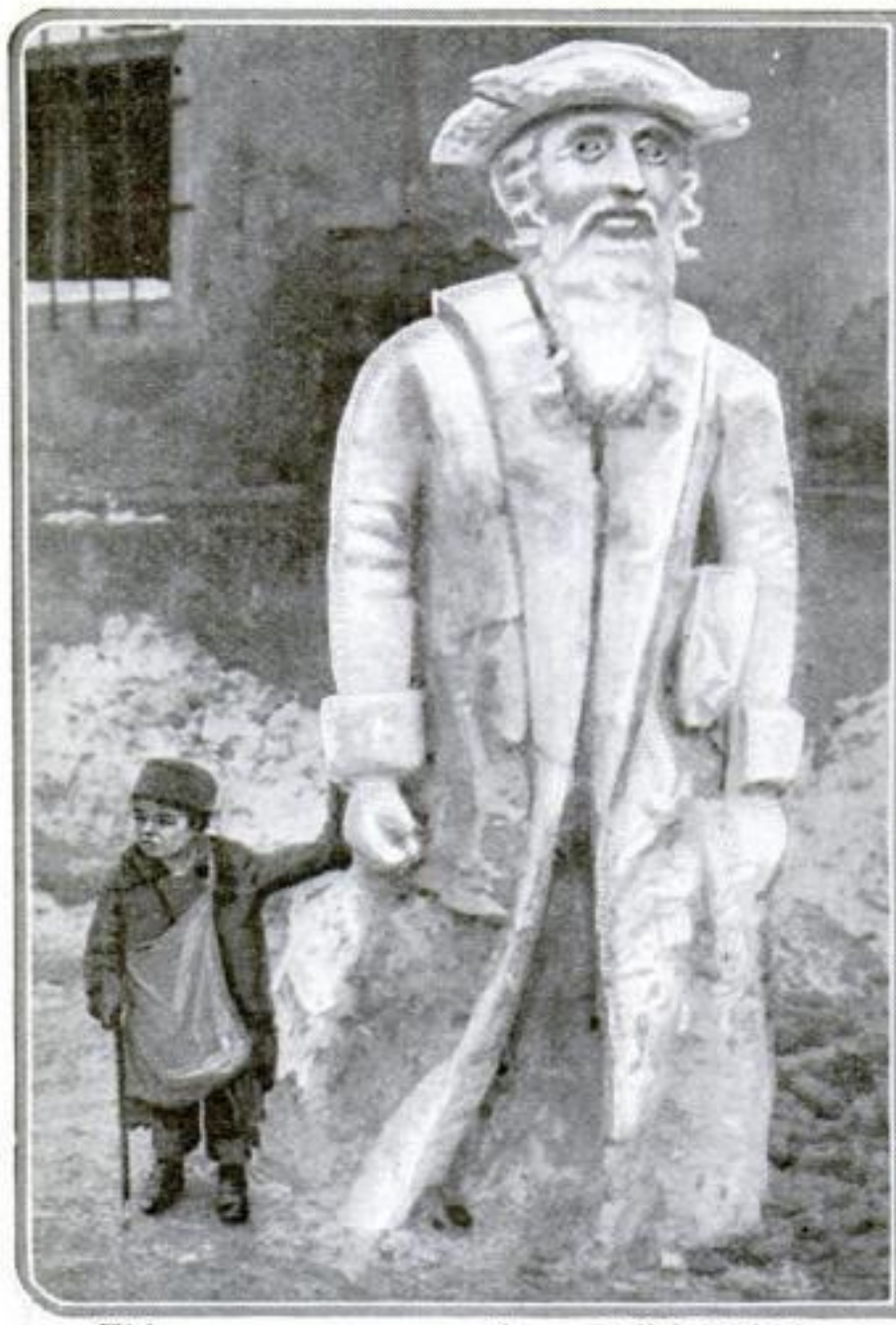
Bridging a crevasse is an undertaking which requires a cool head, a stout heart and plenty of courage even after every reasonable precaution has been taken. A single slip or the caving in of the frozen snow upon which rests the ends of the ladder would be equally fatal



One of the most strenuous, dangerous and fascinating phases of mountaincering in Switzerland is the conquest of the rugged and forbidding looking peaks of glacier ice which rear their heads above the clouds. To accomplish such an ascent is a severe test of human courage and endurance not easily forgotten by the daring tourist. It is extremely unsafe to undertake such ascents without the assistance of experienced guides. The neglect of this precaution by tourists causes many fatal accidents

Real mountaineering is practically impossible during the winter months and the tourists in Switzerland, particularly at St. Moritz, which is famous as a winter mountain resort, find an outlet for their energy and love of exhilarating sport in bobsleighing down the long slopes

Made in Winter's Open Air War Studio



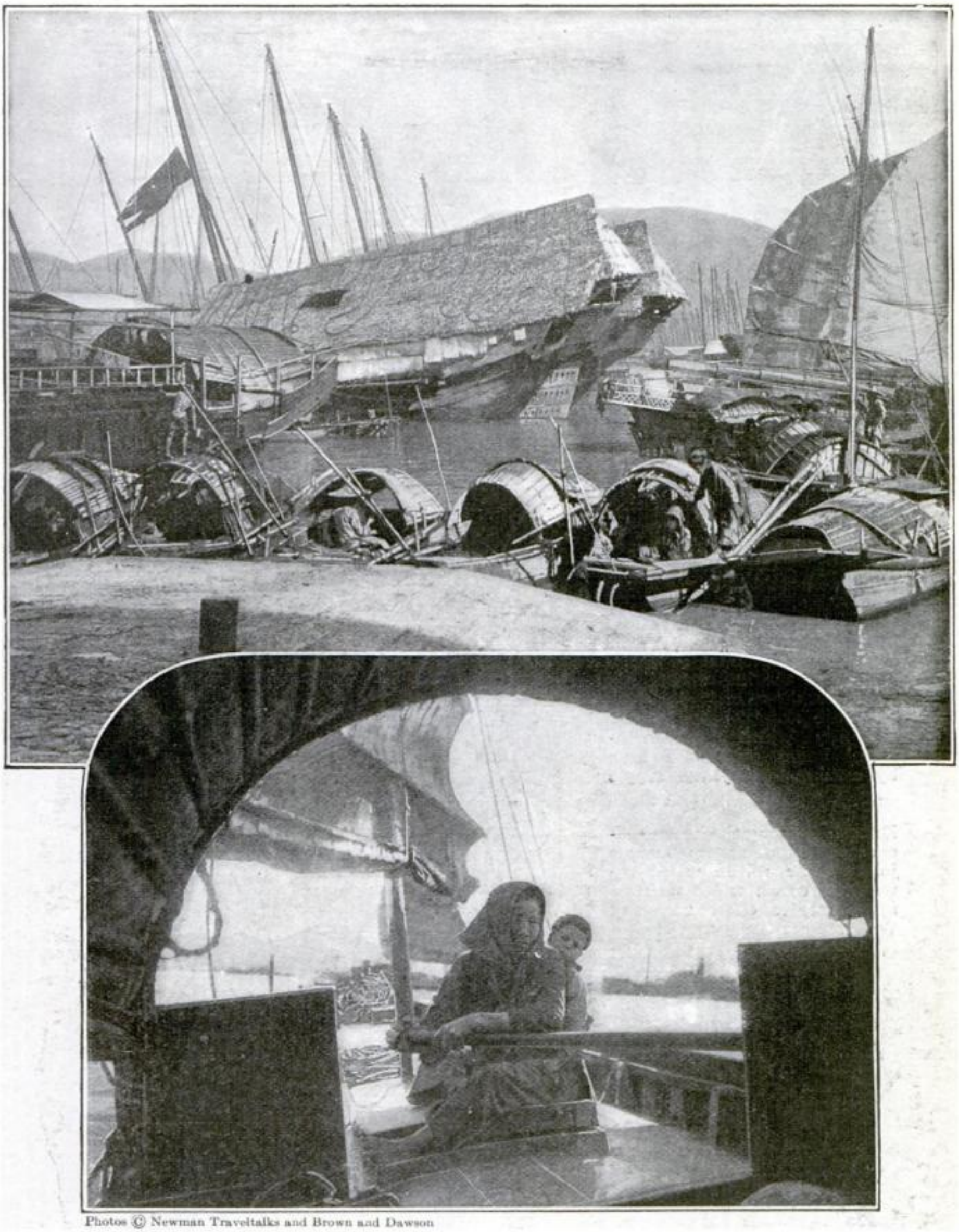
This snowman representing a Polish Rabbi was made by a German soldier in Galicia

Winter has draped one of the Sirens of the fountain, at the Place de la Concorde, Paris

Photos © Press Illus Serv.

German soldiers behind the East front are responsible for this clever bit of snow sculpture, which has the appearance of a real automobile after a trip in a very heavy snowstorm

Sampans, the Quaint Fishing Craft of the Far East



Photos © Newman Traveltalks and Brown and Dawson

At top: Sampans, the popular fishing craft of China, Japan and neighboring islands, lying at dock. All sampans are characterized by the mat roofing. In spite of all foreign accessories, they closely resemble American skiffs

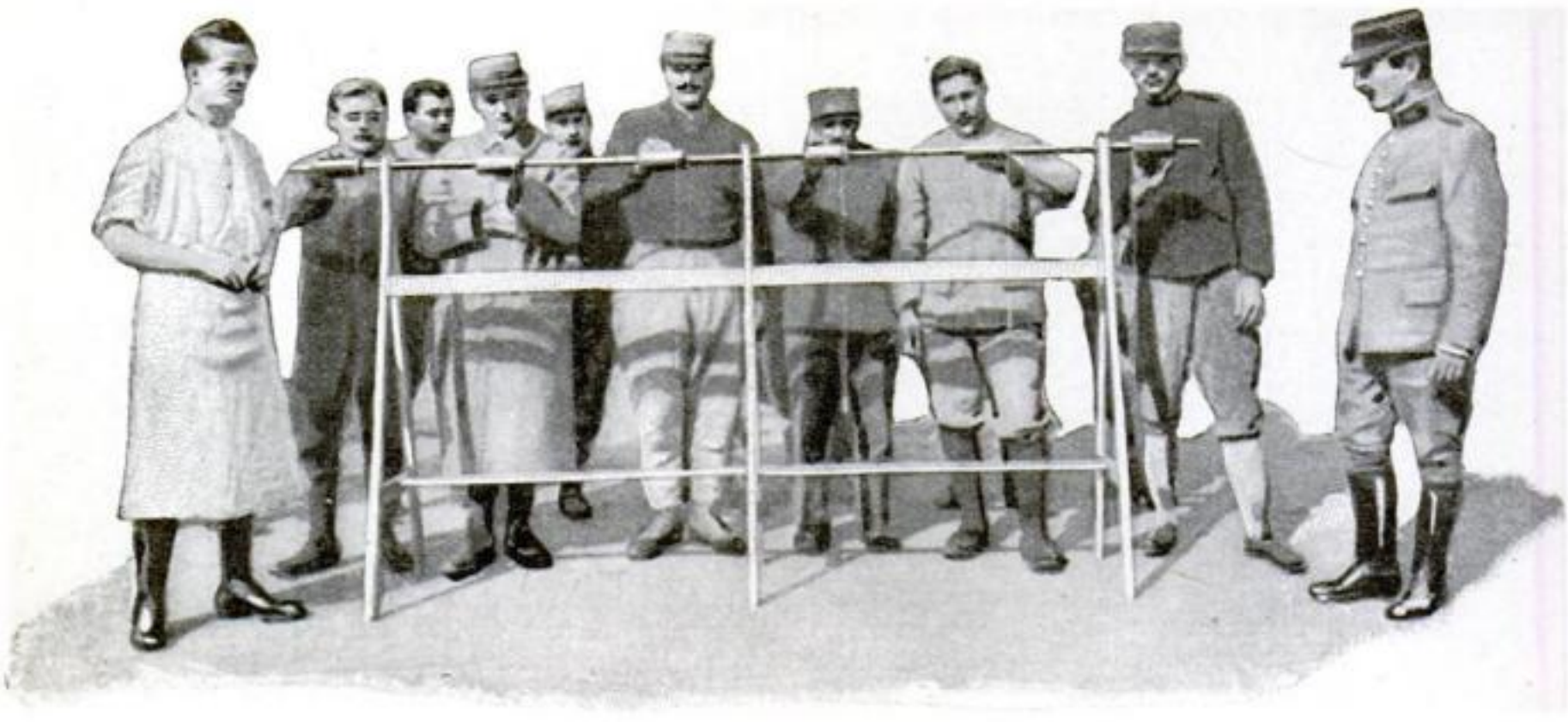
Above: A Chinese mother sailing a sampan and carrying her child on her back in much the same manner that an Indian squaw carries her papoose. Most sampans are propelled with a scull; this one has a large, picturesque and dirty sail

Little Wooden Exercisers Make

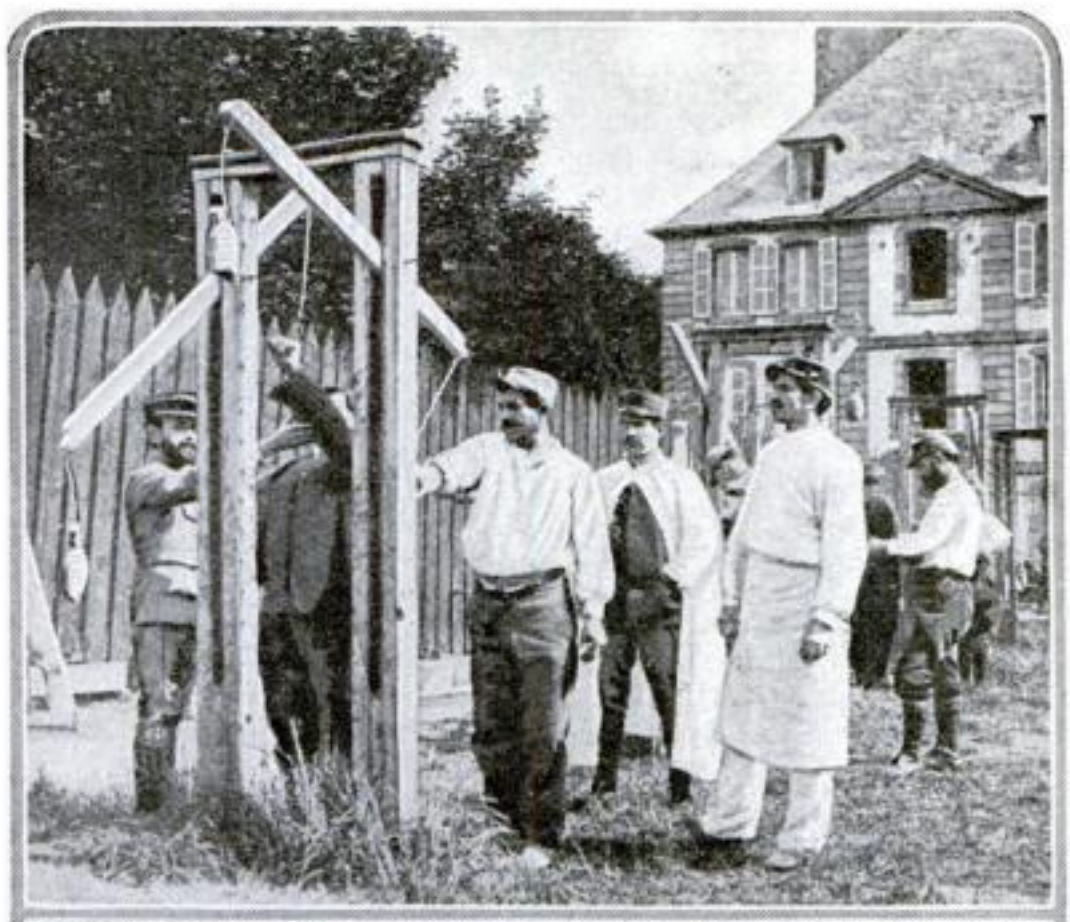
Restoring fingers to suppleness after an operation. They press on keys. The French have found such methods of much use

Major Bellemanière, Surgeon of the Fautras Hospital at Brest, France, is the inventor of the apparatus shown on these pages. They are simple, yet effective. At right: Walking over an inclined board cures stiff legs; by making their joints supple

Below: Turning the heavy rollers with the fingers loosens joints. The rollers wind up weighted cords; which makes a much greater effort necessary

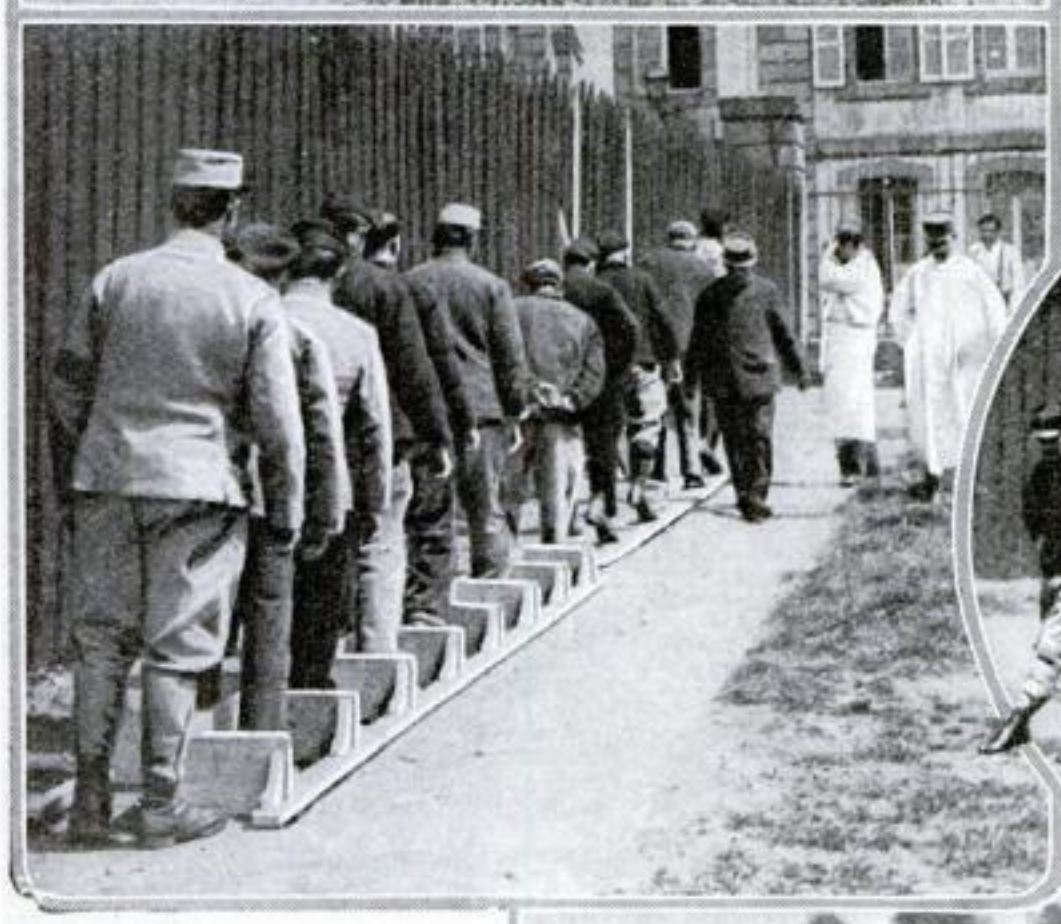


Wounded Men Agile Again



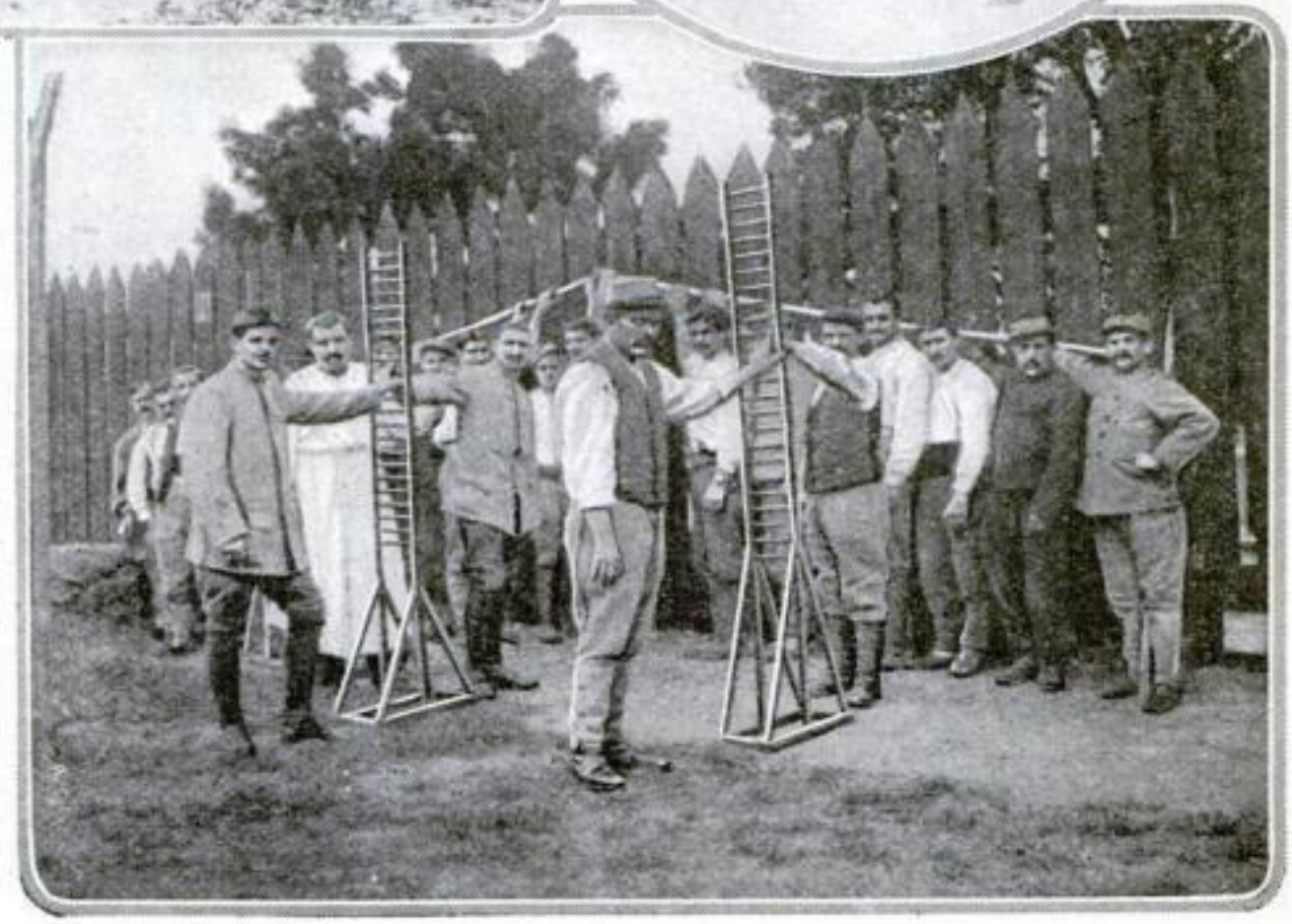
An arm exerciser. The convalescent soldiers seize the dangling weights and work them back and forth. Several machines are here seen in operation at one time

Below: Learning to walk again. Wounded soldiers who are all right as to legs assist those who are not. Medical officers carefully direct the important work

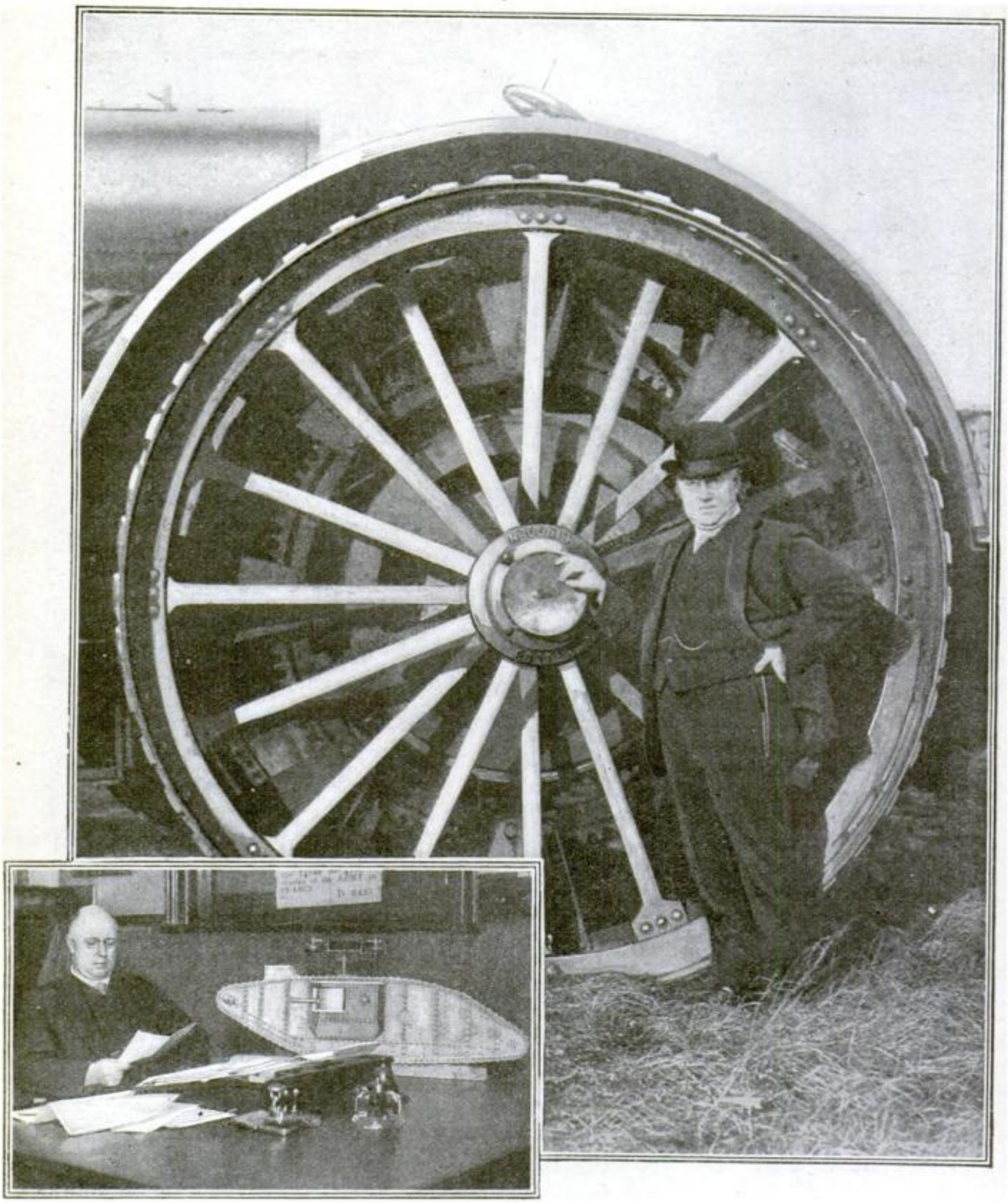


Above: Stepping in the pigeon-holes requires careful walking. It re-educates muscles and joints long unused. Here seemingly lost abilities are regained

At right: Exercising arms and shoulders. Each day the soldiers try to reach higher rungs on the tall, test-ladders



The Man Who Invented the "Tank"



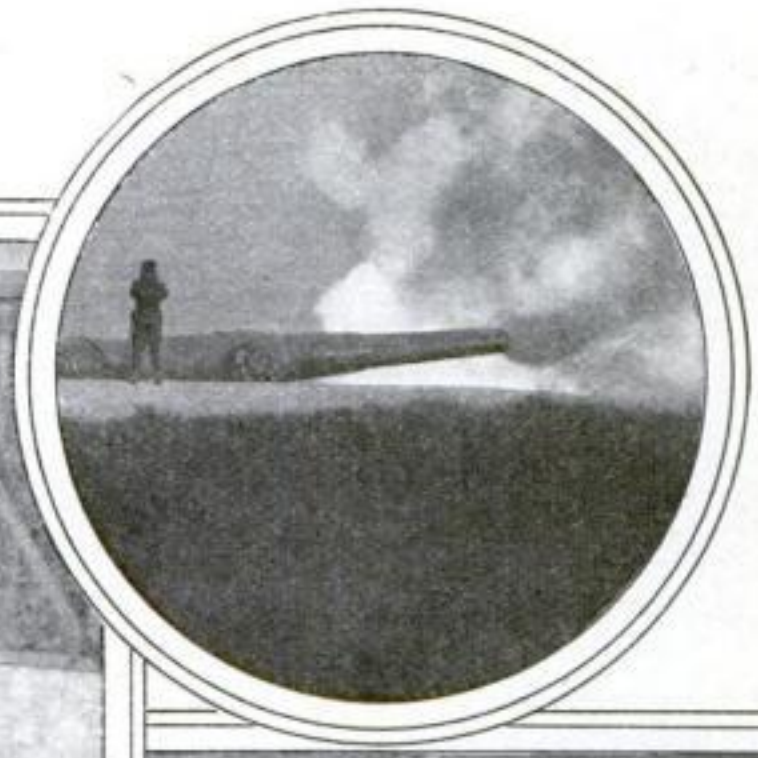
The Dreadnought of the Battlefield and Its Father

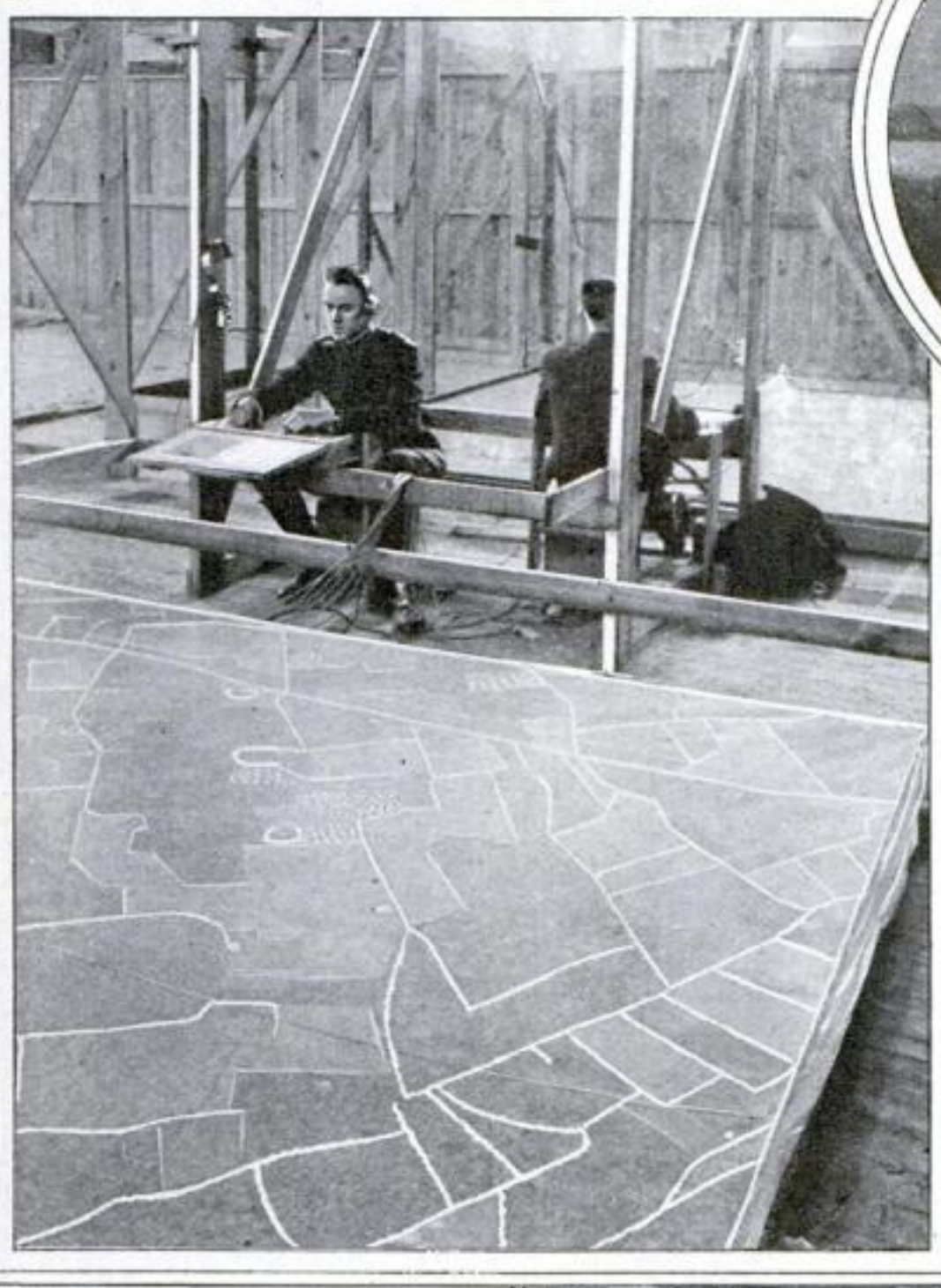
This is Sir William Tritton beside one of his newest and hugest tractors, useful in dragging the heaviest artillery. He and Col. E. D. Swinton are the inventors of the far famed "tank". Concerning the advent of the tanks, the widely-known English writer, Ian Hay, recently wrote:

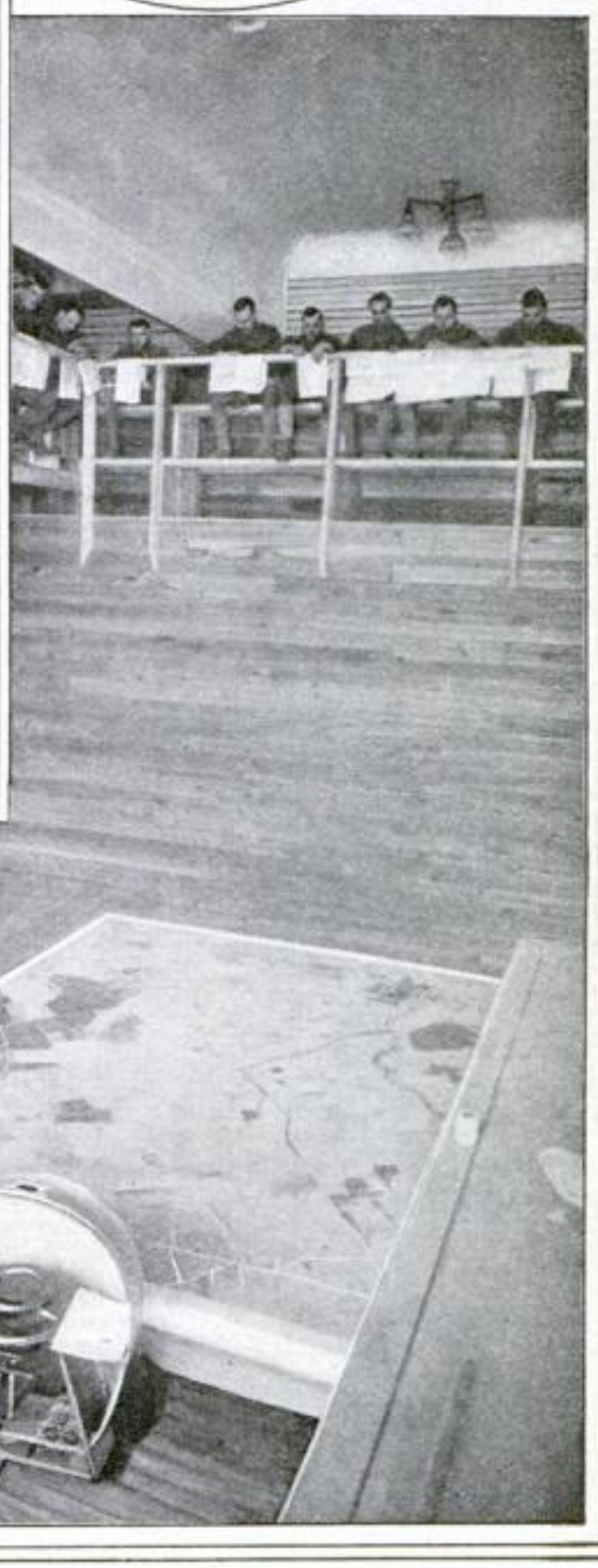
"Down in the forest something stirred. From the depths of the wood opposite came a crackling, crunching sound, as of some prehistoric beast forcing its way through tropical undergrowth. And then, suddenly, out from the thinning edge there loomed a monster—a monstrosity. It did not glide, it did not walk. It wallowed. It lurched, with now and then a laborious heave of its shoulders. It fumbled over a low bank. It crossed a ditch, by the simple expedient of rolling the ditch out flat. In the middle of the clearing, twenty yards farther on, gaped an enormous shellcrater, a present from the Kaiser. Into this the creature plunged blindly, to emerge, panting and puffing, on the farther side. The tank took notice of nothing. None whatever. She simply went waddling on, onward—toward Berlin."

Just As If They Were In Airplanes

Because radio men are sent up in airplanes to direct the fire of the big guns in the rear, the United States Army has established a new interesting school



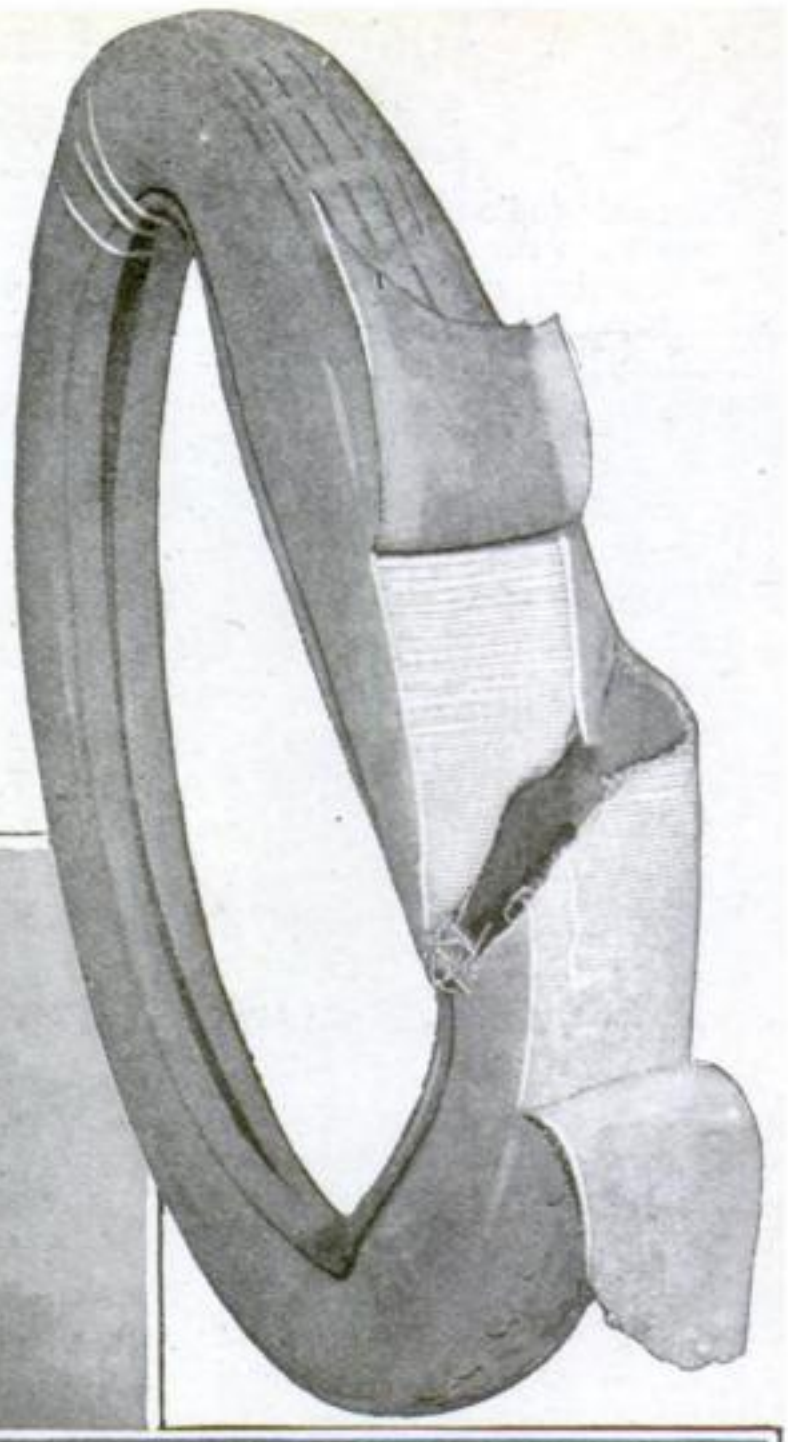




At our aviation schools an attempt is made to mimic actual working conditions as closely as possible. Here a wireless student is looking down on a panoramic map as he would from an airplane. He flashes back what he sees

The boys in the gallery see objects on the map just as they would from a height of 6,000 feet. The instructor makes lights flash on the map, indicating artillery fire. The students signal opinions as to hits and misses

Did They Do a Good Job the Last Time They Vulcanized Your Tires? It Is By No Means a Simple Piece of Work

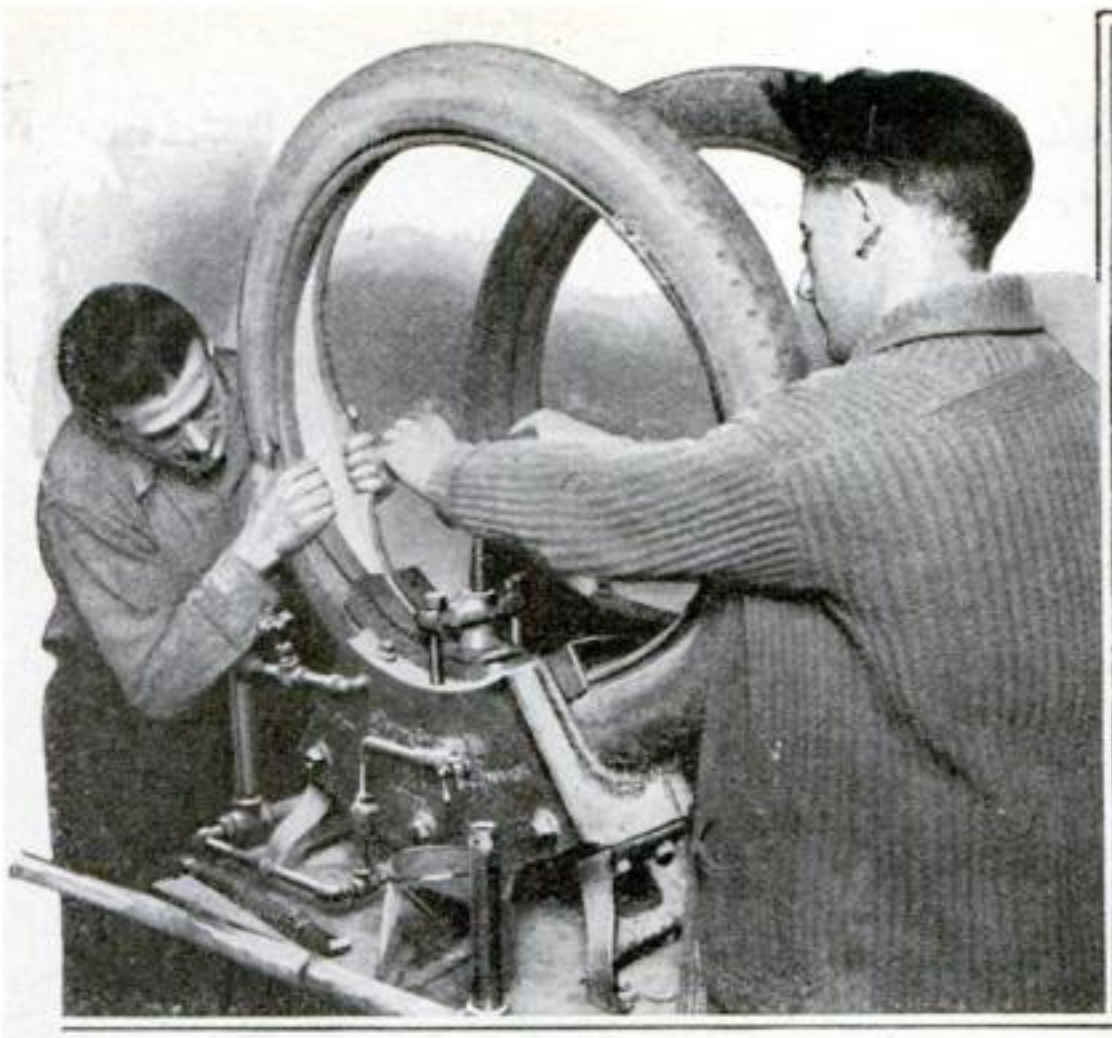


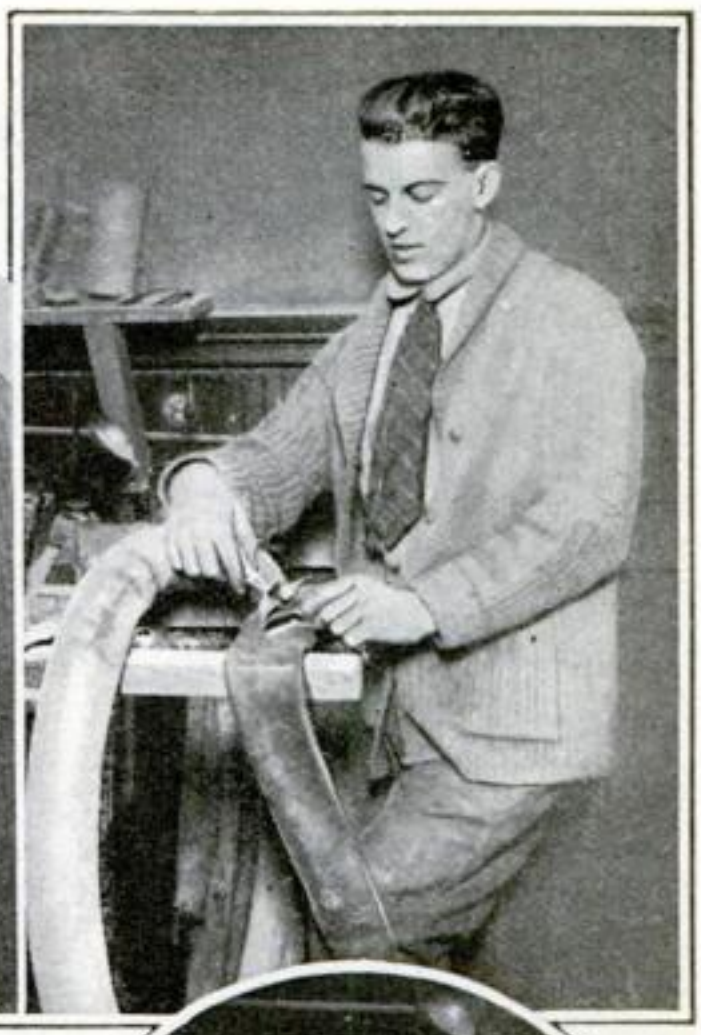
First the tread should be stripped back several inches from the rupture as here shown. Next "step" back the inner plies

Photos © Press Illus. Serv.

If the plies aren't "stepped" back; that is, cut off one behind another stair-step style, all the breaks in the fabric come in one place. There is no interlacing of layers; so a blowout can very easily occur again

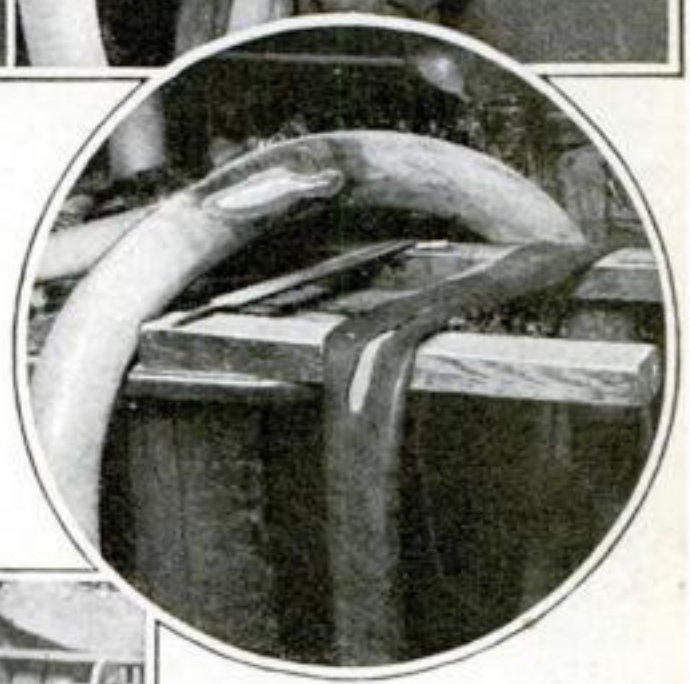
Be wary of the tire-vulcanizing job that is simply a corking-up of a hole with a rubber plug. It will not hold for long, nor will it ride smoothly. At right: Carefully smoothing up a tire before vulcanizing it

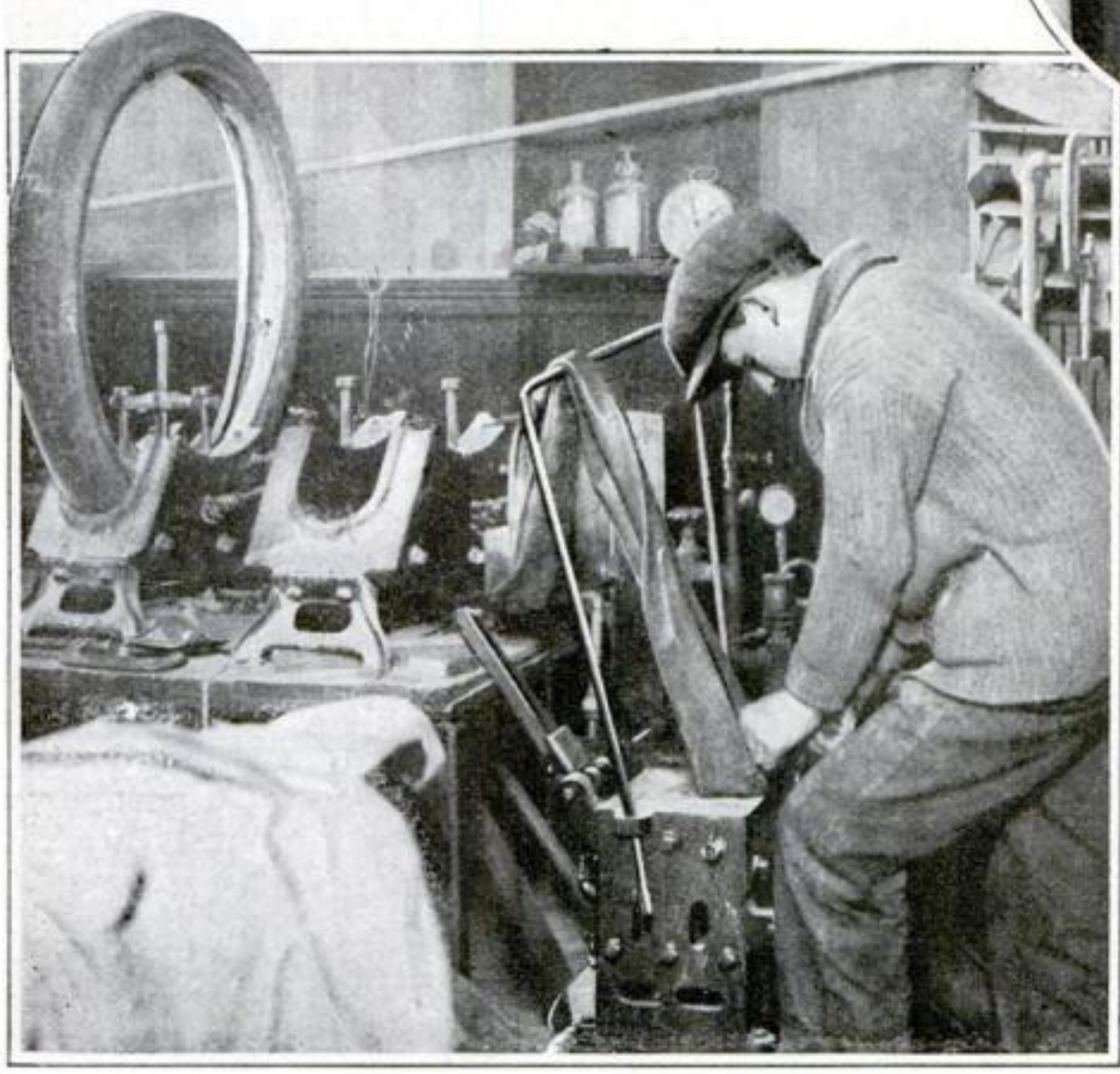




Above: At the vulcanizers. No cook ever needed to know more about his job than must the tire vulcanizer about his. Rubber can easily be overcured, undercured, blistered, hardened, and rendered in bad humor generally

Above, at right: Repairing an inner tube. First trim back the edges and wash with benzene. Apply cement. Let it dry. Insert a piece of repair sheet. Fill in the hole with gum until it is flush with outside of tire





Above: Trimmed-away holes. Back of these, and inside the tire, go the pieces of sheet rubber (raw-gum side toward operator) that serve as a backing and reinforcement of the rubber-gum filler which is used.

At left: Vulcanizing inner tubes. It takes only a relatively few minutes to cure inner tubes. The work is done on a flat plate heated by steam and equipped with short, hinged, clamping levers

Would She Be Crushed by the Sea?

How the Navy finds out if submarines may be submerged with safety to great depths

By Robert G. Skerrett

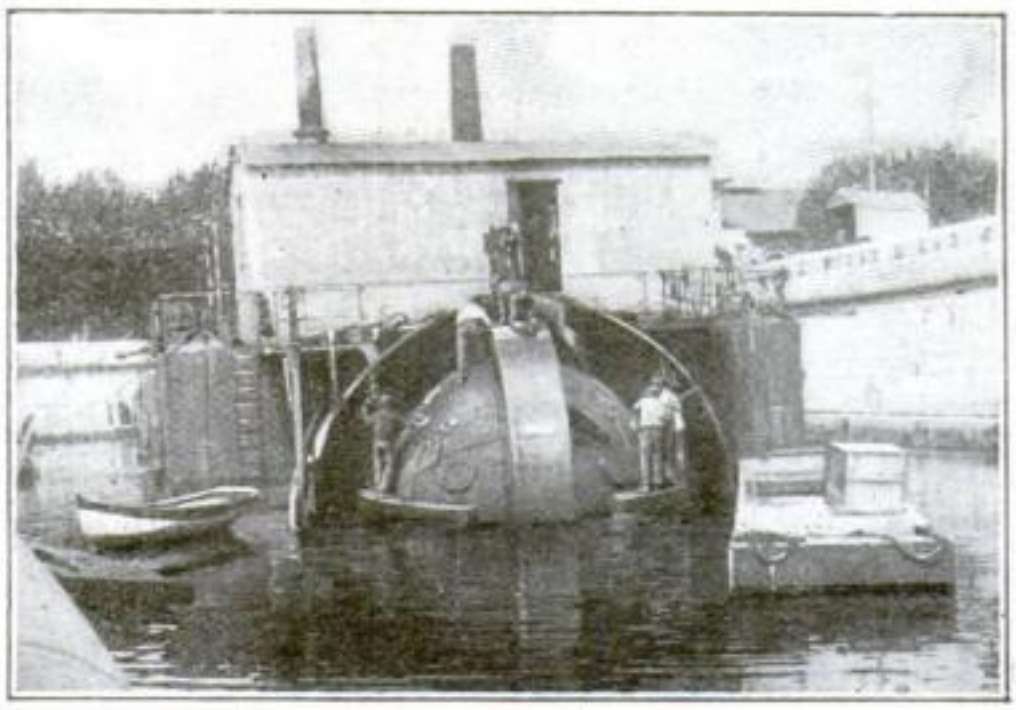
IT has recently been said that many of Germany's submarines have been carried to the bottom by reason of inherent weaknesses—structural faults, in brief. This means that the hastily built U-boats have sprung a leak and foundered simply because the defects were not discovered before sending the craft out upon active service.

The Italians shrewdly anticipated the results of wartime pressure in turning out in haste a large number of under-water torpedo boats; and Major Cesare Laurenti cleverly designed a testing dock which would make it possible to subject a submarine to the physical stresses of submergence at any practicable depth without risking the boat the while in deep water. That is to say, the submersible could be tested in harbor, right at the building yard, where her constructors could make sure that she was absolutely sound in hull. The United States Navy also uses the Laurenti dock to determine the fitness of its submarines for sea.

How can this be done? The hulls of these vessels must be sturdy enough and tight enough to withstand the searching pressure of the sea 300 feet down below the surace. Laurenti's novel dock consists mainly of a long steel tube which is capable of resisting a pressure from within corresponding to a crushing force at any prescribed submergence; only the dock always remains at the surface. One end of this tube is permanently sealed, and the other can be closed by a great, globular caisson or gate. By swinging this gate aside, when the dock is in proper condition, a submarine can be floated into the tube, settled upon keel blocks and otherwise held from shifting when the gate is sealed.

The cylinder is completely filled with water. The submarine is then subjected to external pressure just as she would be if lowered deep into the sea. But there is this difference; her crew are inside of her and stationed where they can watch for leaks and observe certain instruments that show how much the hull yields to the exterior water pressure, and whether or not the structure returns to its original lines when this pressure is relieved. The testing pressure is gradually raised by means of powerful pumps on the dock. They try to force more water into the already filled cylinder, and thus the submarine is subjected to a crushing force which can be raised to correspond with that at any assumed depth.

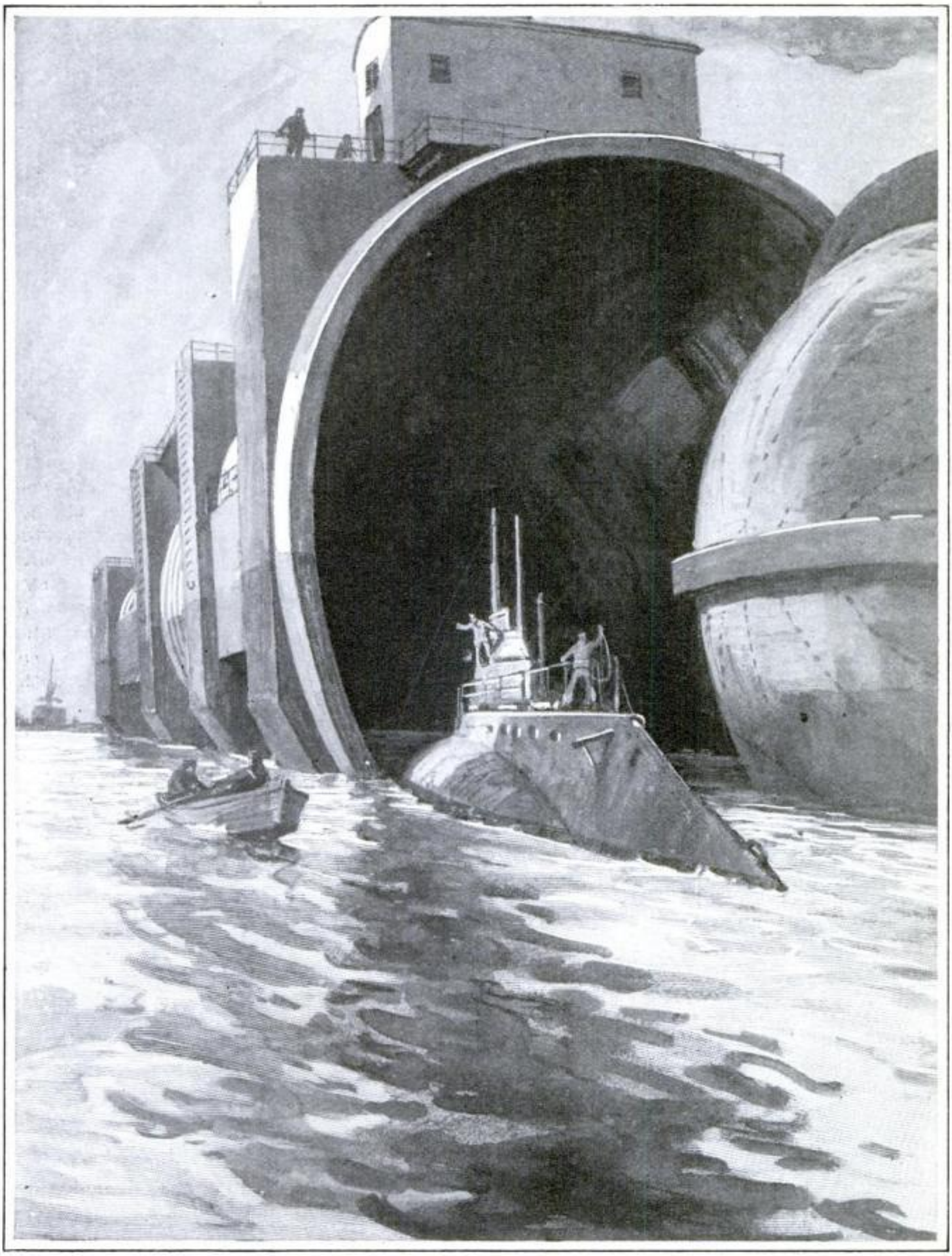
During the test, the observers in the submarine are in telephonic communication with the people in charge of the pumping plant, and should anything go wrong or a grave leak develop, the pressure can be lowered instantly and the great tube drained in a few minutes. Thus, while imitating the conditions of a deep submergence there are none of the dangers that might be met if the boat were out at sea.



When the submarine is well inside, the great globular door is tightly closed

In the last few years, under-water torpedo boats have been modified in order to meet changing military needs. The Laurenti dock makes it possible to try them out before going into actual service.

American "Tin Fish" are Tested in Cylinders



The Laurenti dock makes it possible to test submarines under conditions approximating deep-sea submergence. The submarine goes inside, the door shuts and water under any pressure desired is forced in. Defects in construction soon reveal themselves. The crew inside the submarine telephones results to helpers without. Submarines deteriorate quickly, and frequently where least expected. This method of testing is sure in result. The dock may be used in salving sunken submarines

Ventilated Costumes for Use in the Arctic Circle

EVEN in the Arctic Circle, there is danger of perspiring when the temperature is endeavoring to drop through the thermometer. The colder the weather, the greater the danger. Swathed in heavy furs, as the white man goes, he may get overheated while traveling. When he stops to make camp, he will freeze in a very short time. Terrible suffering is the result.

The Eskimo has solved the problem of how to keep warm without perspiring, in a simple but original manner. Instead of covering himself completely with Arctic furs, he leaves some portion of his body partly uncovered. This allows the air to penetrate between his heavy furs and his body and ventilates his costume.

If the Eskimo woman from East Greenland, shown in the illustration, remains out of doors for some time in the most severe part of the year, she covers the middle of the open space above her boots with belts of foxtails, but adjusted in such a way that she will get the necessary air ventilation.

This Eskimo woman wears a costume in which there is an open space for ventilation between the boots and the trousers

In North Greenland, the men's suits have an open space around the waist, between the coat and trousers, while the Greenland tribes in Northern Canada wear wide, short trousers, which expose the knee and part of the leg to the cold air. The leg may be partially protected when walking or working. I wore this costume myself when on my Arctic exploring expeditions.—CHRISTIAN LEDEN.

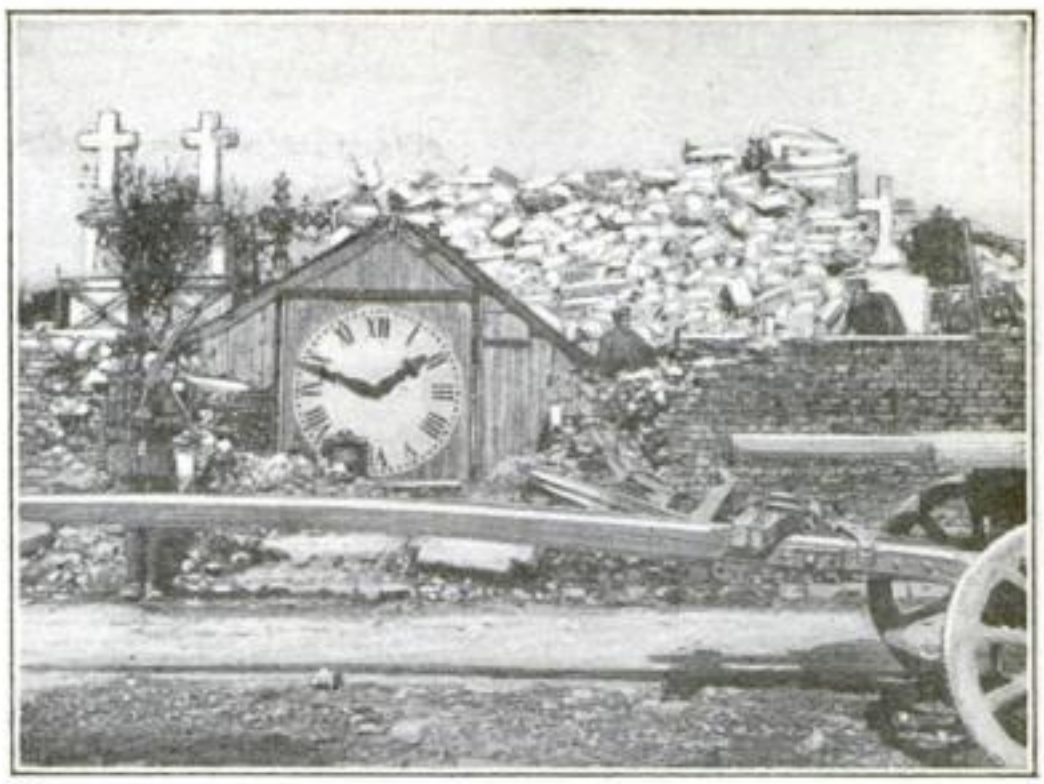
Unlimited Heat—But How Can You Use It?

WHY should we enrich the coal barons every winter, in order to keep warm, though in summer we have such a superabundance of heat that we must pay tribute to the ice kings in order to be comfortable? It is exasperating to think of the warmth that goes to waste in the dog days. How soon will mankind discover a cheap method of bottling it up for use when wanted? Equally tantalizing is the thought of the enormous amount of heat in the interior of the earth, which, as far as we know, is of no use to anybody. Why can we not tap it, for use both as heat and power? Attempts have been made by engineers to harness hot springs, but the power thus produced was insignificant. It has been suggested that the continuous streams of lava which flow to the sea at Stromboli, in the Mediterranean, might in some way be made to do useful work. Sir Charles Parsons, in an address before the British Association for the Advancement of Science, once discussed the feasibility of sinking a bore hole 12 miles deep, at which the temperature of the rock would probably be more than 270 degrees Fahrenheit, and down which water would be pumped to return to the earth's surface at a high temperature. Such a boring would cost millions of dollars, if it could be made at all.

It would surely be sinking money "in a hole in the ground!" But it won't be done for some days yet.

Here Is Another "Shortest Road in the World"

YOU have heard of shortest railroads before. Always they're the most abbreviated ever. But off-hand one would grant the prize to Missoula, Montana. It has a railroad only one hundred feet long. It connects the Northern Pacific with the C. M. & St. P. and is used as a transfer. It has no equipment, no employees, and no stations, yet the company that owns it gets fifty cents for every car that passes over its rails. Sixteen thousand have done so thus far. Think of it!



© Underwood and Underwood

The clock now forming the front of a British Tommy's hut was part of a church tower destroyed by the Germans

Steaming Frozen Coal Out of Freight Cars

THE advantages of persuasion over force have received mechanical application in removing coal which ice had frozen into an immovable mass while it was waiting in freight cars on one of the sidings of a big New York terminal.

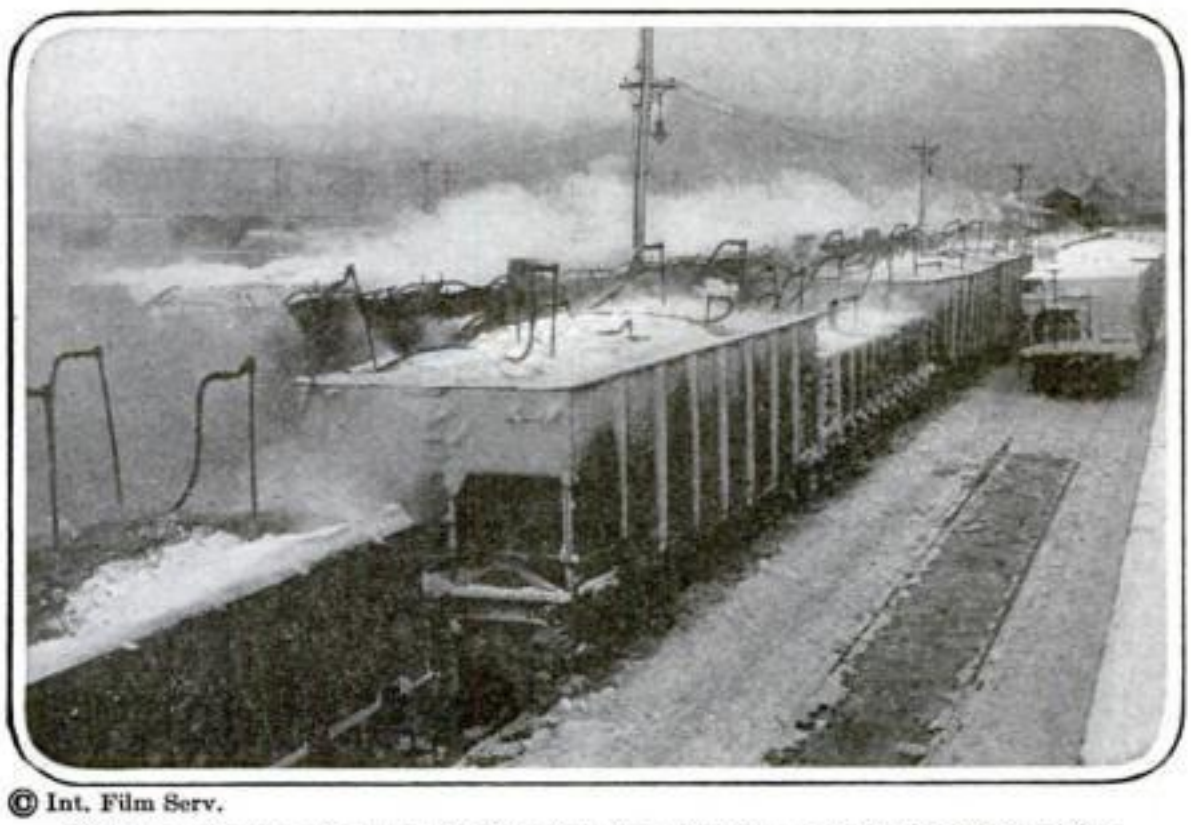
Some railways tried to blast the much needed fuel out of the cars, then a railroad man conceived the idea of inserting steam pipes into the coal to thaw it into an amenable state. This persuasive measure was successful, and the coal was soon quite loose and ready for quick removal.

Time Is with the Allies—The Strange Fate of a Clock

THE German's have tried many unsuccessful expedients to catch progressive Father Time and force him back into his medieval trappings, which they believe to be still in fashion.

When the picturesque old church at Etrelliers fell before the enemy's artillery, though the shell of the symbolically sacred structure was absolutely ruined, the clock escaped destruction.

Now it forms the front wall of a British Tommy's hut which is perched in front of the sheltering pile of debris. Time is with the Allies.



© Int. Film Serv.

Steam pipes are inserted into the frozen mass to thaw the much needed coal loose. The plan is eminently successful

Louisiana Has Adopted Cactus Candy

LOUISIANA has a new product. It is cactus candy. The cactus is peeled, dipped in hot syrup or molasses, and coated with powdered sugar. Many cane syrups and other similar products are common in every home in the south, so the confection is easily made. Sugar mills are also taking it up as a side product to be turned out during the slack seasons of the year.

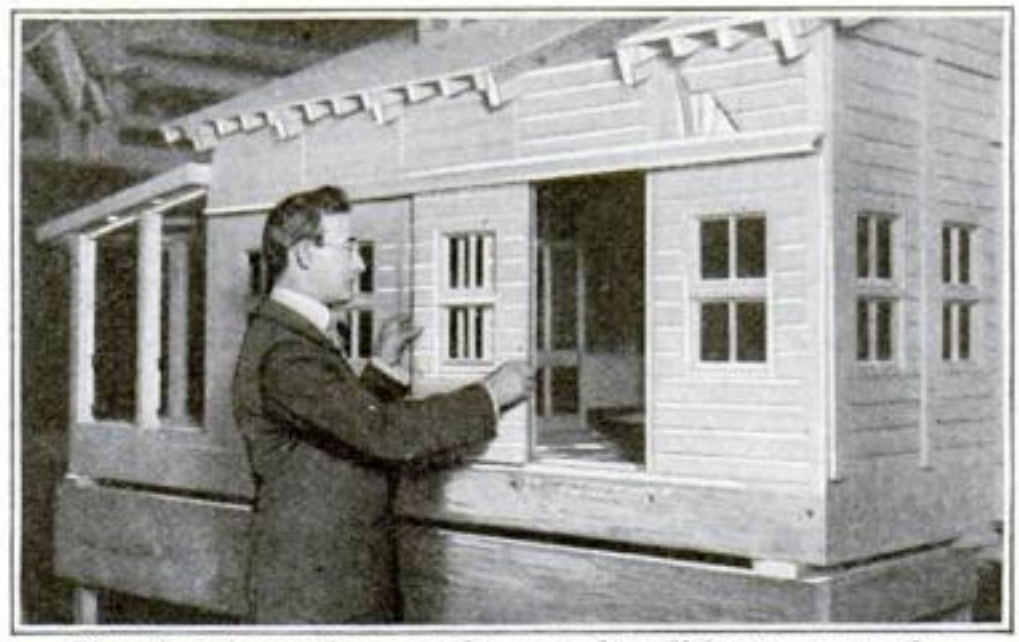
And Now the Liberty Hospital

Dr. Osborn's plan contemplates sectional structures adaptable for dwelling purposes after the war

WE have the Liberty Motor and the Liberty Truck and now we are to have the Liberty Hospital. Heretofore hospital buildings have not served any purpose after their usefulness during war. The new Liberty Hospital as designed by Dr. Henry Fairfield Osborn, President of the American Museum of Natural History, may be converted into dwellings when the war is over.

A complete model of this hospital was constructed by Mr. H. F. Beers, Superintendent of Construction of the American Museum of Natural History. The miniature hospital is complete in every detail. The side sections can be pushed out from their accustomed alignment into a small track at the top of the outer walls on which they can be shoved entirely out of the way. On warm sunny days, the wards of the hospital can thus be exposed, or the panels may be so manipulated as to screen half of the length of the wall.

The hospital will be built in five foot units. On one side, and on one end are large porches. The supports of the porches are held in place by devices similar to steel hooks which are used in joining together the joints of old fashioned beds. The veranda roof is made of canvas and can be rolled up and unrolled as easily as can the ordinary awning. The end panels are four feet, nine inches by eight feet, and the side panels are five feet wide by seven feet deep. The floor is made in sections of five by seven feet and the ceiling panels have the same dimensions.

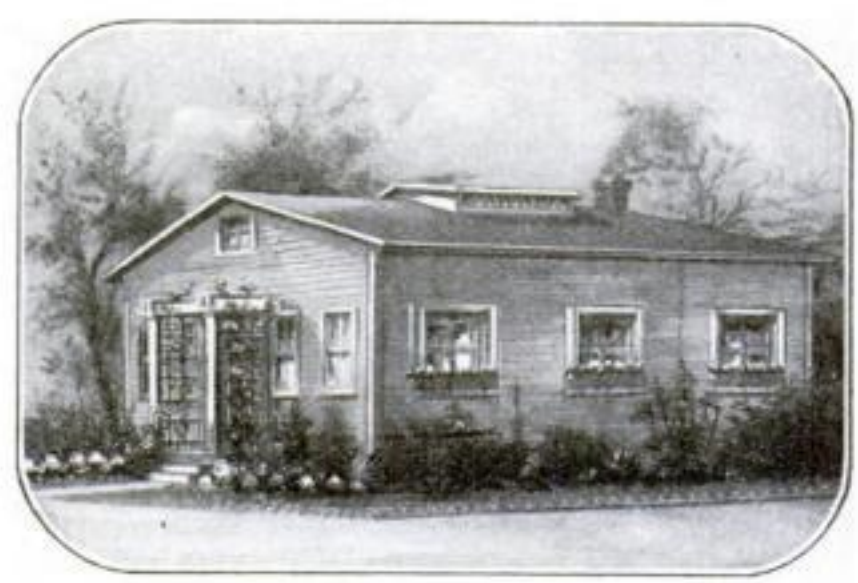


Showing how the panels may be slid one over the other if it is desirable to open up one side of the hospital. Each of the side sections has two windows

The model of the New Liberty Hospital as designed by Dr. Osborn, of the American Museum of Natural History, and constructed by Mr. H. F. Beers

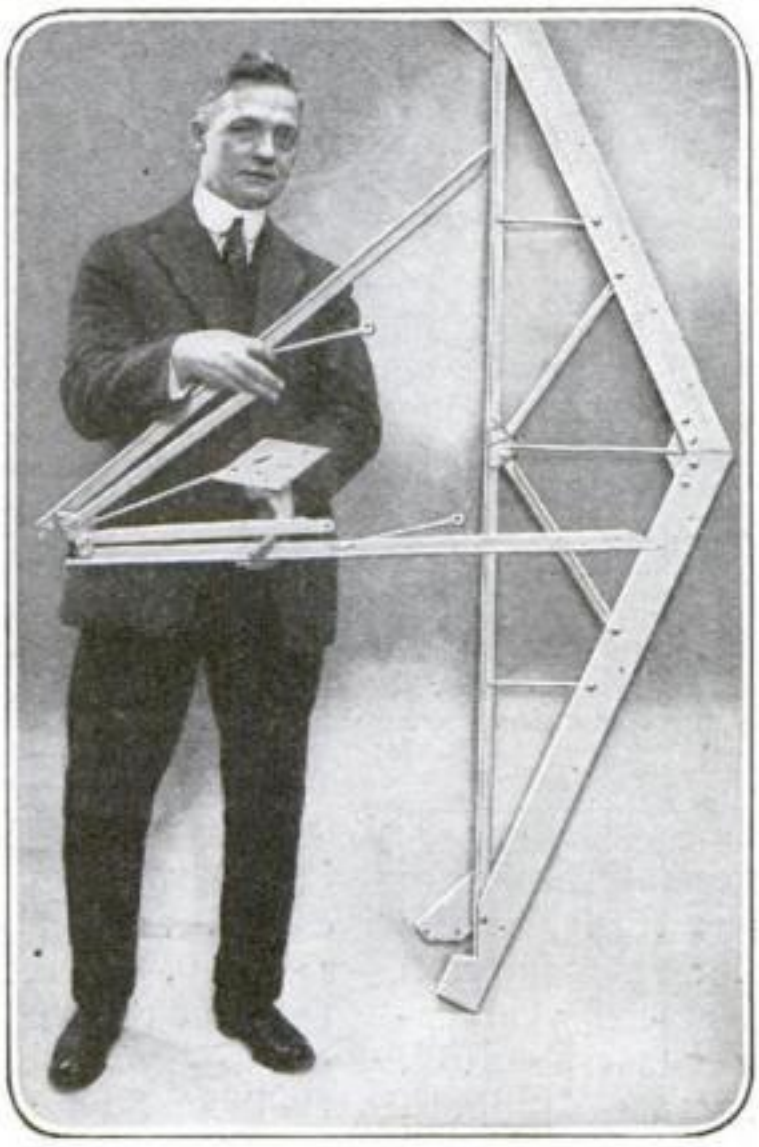
The material which is to be used in these hospitals is cedar, a wood which should last for fifty years. The roof trusses are of steel. They are so hinged that they can be folded into a remarkably small compass which makes transportation both easy and comparatively inexpensive.

The hospital itself may be heated by



After the war—a cozy dwelling made from a detached section of the Liberty Hospital

steam supplied from plants outside the walls. But after the war, when the hospital has been converted into dwelling houses, these houses would have to be heated by stoves. The parts of the hospital are adjusted with such care that the buildings may be taken down, transported and put up as dwellings which may eventually harbor thousands of the homeless refugees when they return to their devastated towns in Belgium and France.



A truss opened and one being folded for transportation. Note how small a space the folded truss takes up

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Brrrrrrr! It's Cold!

Turn up your collar, thrust your hands to the bottom of your pockets, and read about the "Cold Pole" of northern Siberia, where the natives speak patronizingly about Greenland's icy mountains and other such relatively balmy resorts. At the town of Verkoyansk, which would probably never have had any inhabitants if the late Czar's government had not sent occasional batches of exiles thither, the temperature has been known to drop to 90 degrees below zero, which is a "record" for the whole world. While the regions about North and South Poles of the earth are cold all the time, the Siberian Cold Pole gives its inhabitants a comfortable let-up in summer, when the thermometer frequently climbs up into the eighties above zero. During the brief summer season, the life-giving rays of the Sun, which remains above the horizon day and night for some time during the height of the season, exert an intensely stimulating influencing upon the vegetation, and the ground is covered with flowers.

What Kind of a Dog Was It That Went Into Noah's Ark?

"THE ancestry of the dog has been the occasion of much controversy. Many naturalists have considered that it is descended from a single ancestor, such as the common wolf of Europe. Darwin, however, leans toward the theory of multiple origin, and advances much convincing proof in support of his belief. It is well known that many savage tribes have dogs which appear to be simply half-tamed representatives of the particular wild-dog-like animals inhabiting the same regions. The dogs of the American Plains Indians closely resemble the small prairie wolf, or coyote; the husky of the north country is plainly not far removed from the gray wolf; the German sheep dog and the Samoyede are strikingly wolf-like in appearance. Whether our present dogs are the result of crossing these many simple derivatives of wolves and jackals among themselves, or whether there was an original ancestral dog, now extinct, with which the blood of other species has become mingled, we have not yet been able to determine, though so many primordial animal remains have come to light.

"According to St. George Mivart, the dingo is the only wild dog still existing which meets the requirements of an ancestor of our modern breeds. This species is found throughout Australia, and fossil bones which have been found show its presence there from very early times." (*Pets*, by Leo S. Crandall, Henry Holt & Co., New York.)

Screen Thrills Are Cheaper Now

How the motion-picture man saves money

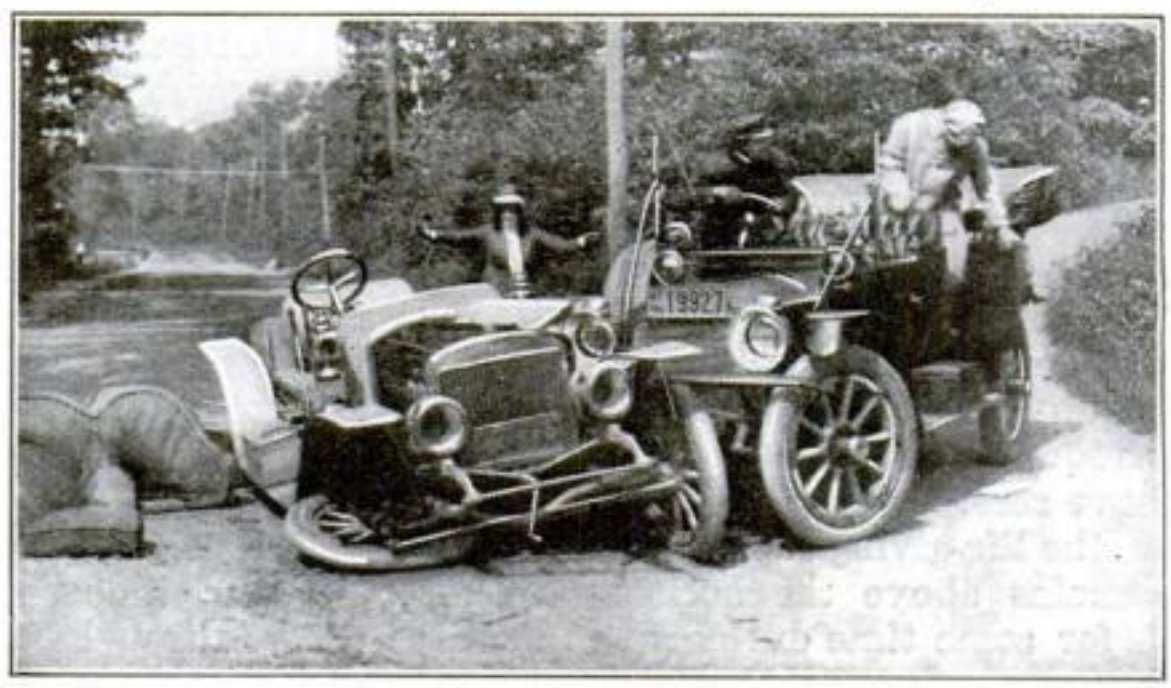
By Prescott Lecky

(Part I) The Start of a Thrilling Accident

In a recent film, the scenario called for the destruction of a high-powered automobile at a railroad crossing, it supposedly having stalled at this thrilling point just as a train arrived. An exact replica of the real machine was made of tin and wood, and brought to the location on a truck as shown above. The real machine is in the foreground. What happened next is shown on the page opposite. The details are harrowing. We shudder.

IN the early days of the motion picture industry, directors were thrifty to the point of parsimony—for money was scarce. Then came an era of wild extravagance—for money was plentiful. And now, having swung too far both ways, the financial pendulum has finally settled down to a business range. This is the day of sane economy—for money is money. And that is why some of the ingenuity that was formerly devoted to spending money is now occupied in saving it. So long as the result remains convincing on the screen, the efficiency man is welcome.

The greatest field for intelligent retrenchment lies in those scenes that call for wholesale calamities and destruction. Until very recently, the automobiles destroyed were the real thing; very old, as a rule, and cheap makes, but real automobiles nevertheless. To-day, the directors of even the wealthiest companies try to avoid this useless expense. If the effect on the screen is just as good, the effect on the expense account is even better.

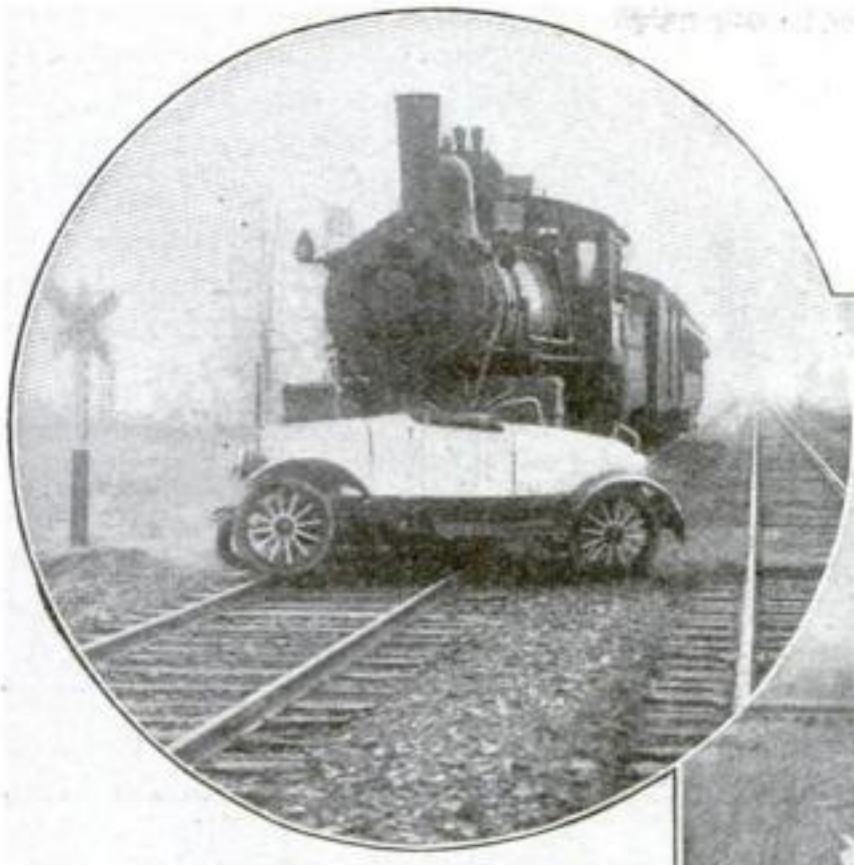


How They Fool 'Em

The above photograph is an excellent illustration both of the effect of the "long shot" and the "camouflage." The "long shot" is a picture taken at a distance, and the obvious result is an obliteration of detail. In this case, as closer examination will show, the cars were not damaged at all. After the apparent collision, shown from a distance, the seats were thrown out, a wheel taken off and a cloud of dust thrown up during the making of the close-up. In other words, the director takes advantage of the well known fact that disorder looks like damage. He gets satisfactory screen effects.

Much cheaper than the dummy model is a literal application of the well-known "camouflage." A cloud of dust before the eye of the camera works many convenient miracles. The pictures take up details.

Saving Money on the Screen Thrill



The Thrilling Accident Part III

And here, at right, is the final scene. The wreck is just as convincing as if it were a $3,000 car. It probably cost less than one-tenth that sum. This is the sort of efficiency that is really worth while, according to present-day studio ideas. Take care of the pennies!

The Thrilling Accident—Part II

As per scenario, the real car stopped on the tracks (see picture in circle) and the occupants jumped out just in time. The dummy car was then substituted. The engine went back up the line and again rushed down upon the crossing. The photograph at left was taken at instant of contact. Note front wheel

Wherein a Car Skidded

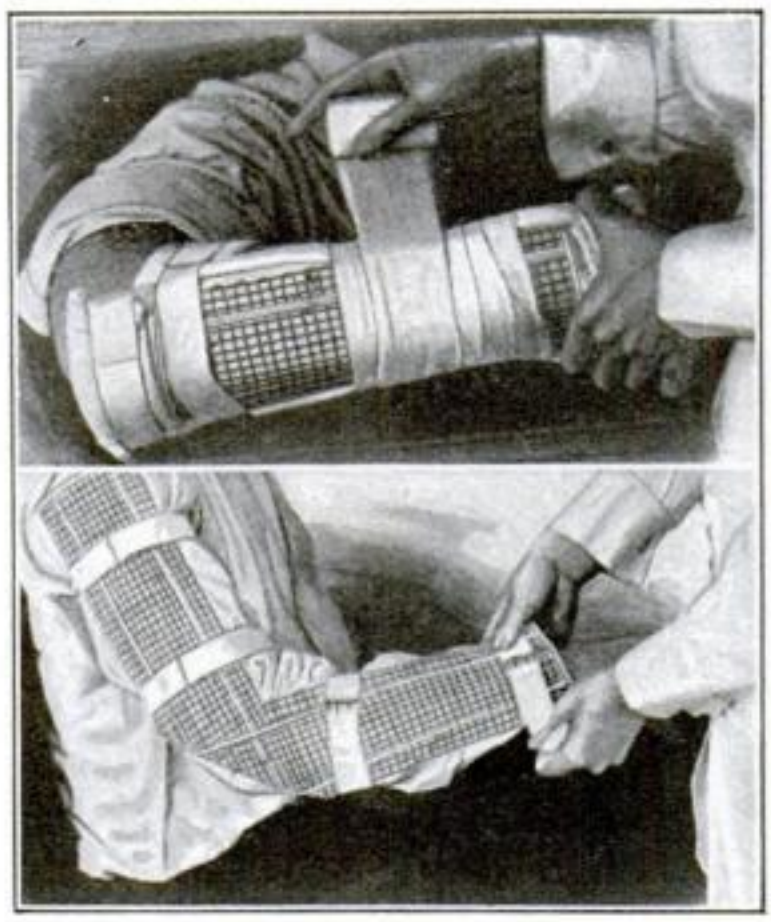
Below: This is a "flash" that immediately followed a skidding scene. The skidding was accomplished harmlessly through the help of a greased pavement, but to show a bad wreck, the car was later taken apart and stood up as shown. Then the players mounted the piled-up parts, and the effect was realistic

The Skidding Made You Gasp

The piled-up wreckage appeared so immediately after the skidding scene, that you thought you saw the car turning over, and before you could take a second look, there was the wreck! And to make the scene complete, the car was next turned completely over on its back, the wheels broken, and victims strewn about. Bloody make-up streaks made the woe convincing. Above we show the final scene

Wire-Netting Instead of Wood for Surgical Splints

A NEW kind of surgical splint in which galvanized wire-netting takes the place of wood, has been put on the market. It has been tried and offers many advantages. The steel entering into the construction of this woven wire splint is so tempered that it can be molded by hand. Being galvanized, the wire is sterilized and at the same time welded into a single piece that cannot fray out at loose ends. As it is porous, it allows a certain amount of evaporation and air circulation to the dressings beneath, which wood or plaster does not. The splint comes rolled like a bandage and is lighter and less bulky than wooden splints.



Two methods of using the wire netting splint are shown in the illustration

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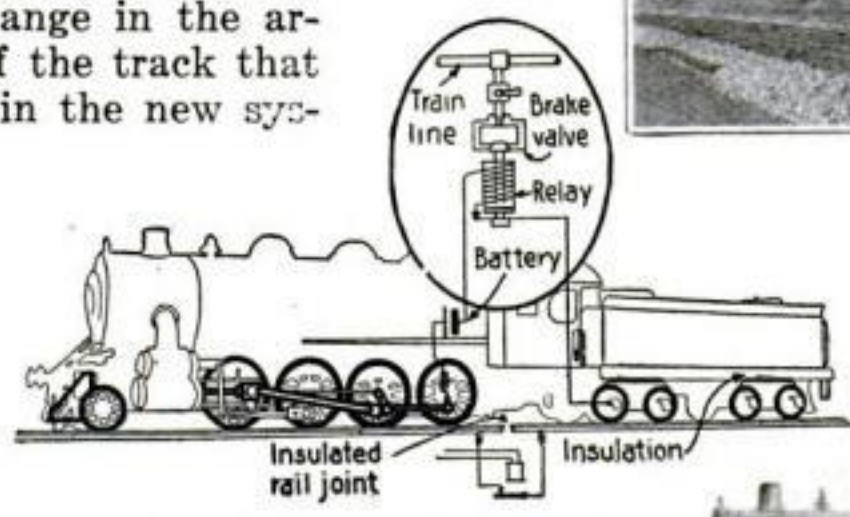
Track Insulation Stops the Trains in This Automatic Control System

THERE are now many methods for automatically stopping a train which has run past a stop signal. But none is simpler than the Gray-Thurber system. No ramps, third rails nor other appliances on the track are required. The only change in the arrangement of the track that is necessary in the new system is a single piece of insulation, placed at the rail joints near the semaphore signals.

Between the insulated rail ends at these joints is a make-and-break relay operated by the same current as the semaphore. In case of danger, the breaking of this current raises the semaphore arm to the "stop" position and, at the same time, it opens the relay. The two rail ends are therefore electrically disconnected from each other.

The valve controlling the brake is normally held inoperative when there is a current going through the valve relay. This current flows from a battery on the locomotive, through the locomotive wheels, the rails, the wheels of the tender, and from thence to the relay. But when the train passes a danger signal, the disconnected rails break this circuit. The relay is demagnetized and a spring opens the valve of the air brakes, stopping the train.

When the semaphore arm goes up, the track relay opens. Should the train try to pass the disconnected rails, the valve relay is demagnetized and the brakes are set



The circle shows the location of the valve relay which sets the brakes on the train when its current is shut off

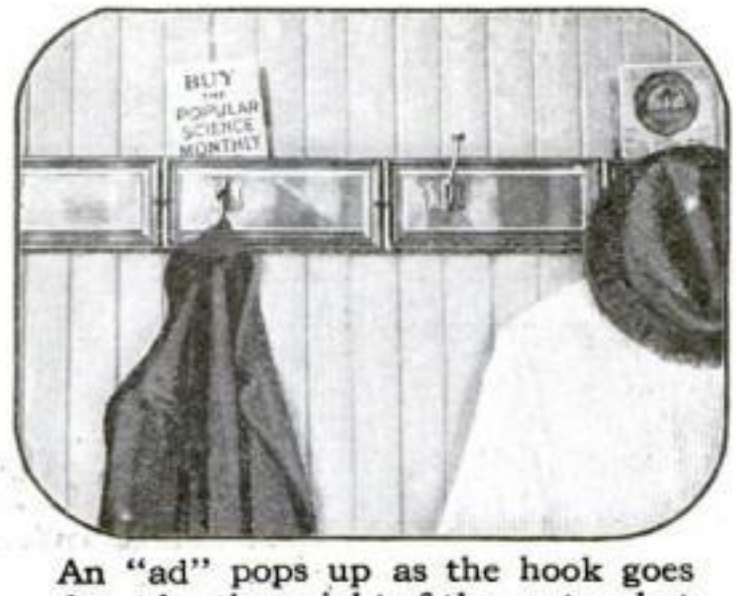
Glasses That You Can Wear In Comfort

PERSONS who are compelled to wear eye glasses know that, as a rule, the frames are either too tight and make the nose sore or so loose that they will not stay on. A Western surgeon thinks he has invented a frame that will do away with pain and profanity at a stroke. Instead of suspending the spectacles by the bridge of your nose only, he has arranged springed extensions ending in small plates that catch the face just above the eye at a spot where they escape a vital nerve or blood vessel This little device holds the glasses firmly in place and relieves most of the pressure on the nose, and at the same time it allows the glasses to be removed easily with one hand.

Simple and effective is this device for giving a firm grip to eyeglasses without nose-pressure

Coat Racks Display Advertising When Coats are Hung

A COAT rack which turns up an advertising card automatically whenever a hat or coat is hung on one of the hooks is now being marketed by a Western novelty concern. The advertising cards fold down into a small box like structure whenever the weight is taken off the hooks. When a coat, hat, or other garment is hung on one of the hooks, the hook is pulled down about four inches, and the advertising card is turned up into view. Naturally the attention of the person hanging up his garment is attracted to the add. This advertising novelty is now being placed in numerous restaurants, and other pubic places.



An "ad" pops up as the hook goes down by the weight of the coat or hat

Allies Restrict Use of Gasoline

IN all the belligerent countries of Europe there is a great scarcity of gasoline, and everywhere the most stringent laws for restricting its use for the running of automobiles have been passed. Touring for pleasure has practically been stopped. In England, some success has been achieved in running cars by coal gas carried in bags on the roof of the cars, but in Italy, with coal at $200 a ton, this substitute is impossible. The price of gasoline is $2 a gallon, when it can be obtained. Somewhat better are the conditions in France, where gasoline may be purchased at $1 a gallon.

Switzerland is feeling the gasoline famine even more seriously than the belligerent nations, stock being so low that all private use of automobiles has ceased. Reports regarding Germany, coming through Switzerland, are to the effect that there is no gasoline shortage for army use, but the lack of rubber is causing serious trouble.

Mike Has a Nose of Brass, But He Should Worry

IT IS being demonstrated to the folks of Mt. Healthy, Ohio, by old Mike, the faithful horse of the street-cleaning department, that a real nose is quite a superfluous thing.

Now if Mike had relied on his own natural nose he would have been dead long ere this.

When Mike's nose ceased to work properly some five years ago, and it seemed that Mike would die of suffocation, Joe Stoppel, his owner, said it would be a shame to let a nice horse like Mike go to the dogs merely because he hadn't the use of his nose.

So Stoppel consulted a horse doctor who told Stoppel to cease grieving, because he, the doctor, could give Mike a new nose by way of his neck.

The doctor made a hole in Mike's neck and opened the windpipe and put a tube into it. At the outer end of the tube he fastened a brass disk which may be seen in the picture.

All the air Mike breathes goes through the disk, up the tube and down Mike's windpipe. On cold days Mike's brass nose even emits steam.

"And he's better'n ever now," says Stoppel. "Giddap Mike."

This horse breathes through his neck. The small brass disk indicates the spot

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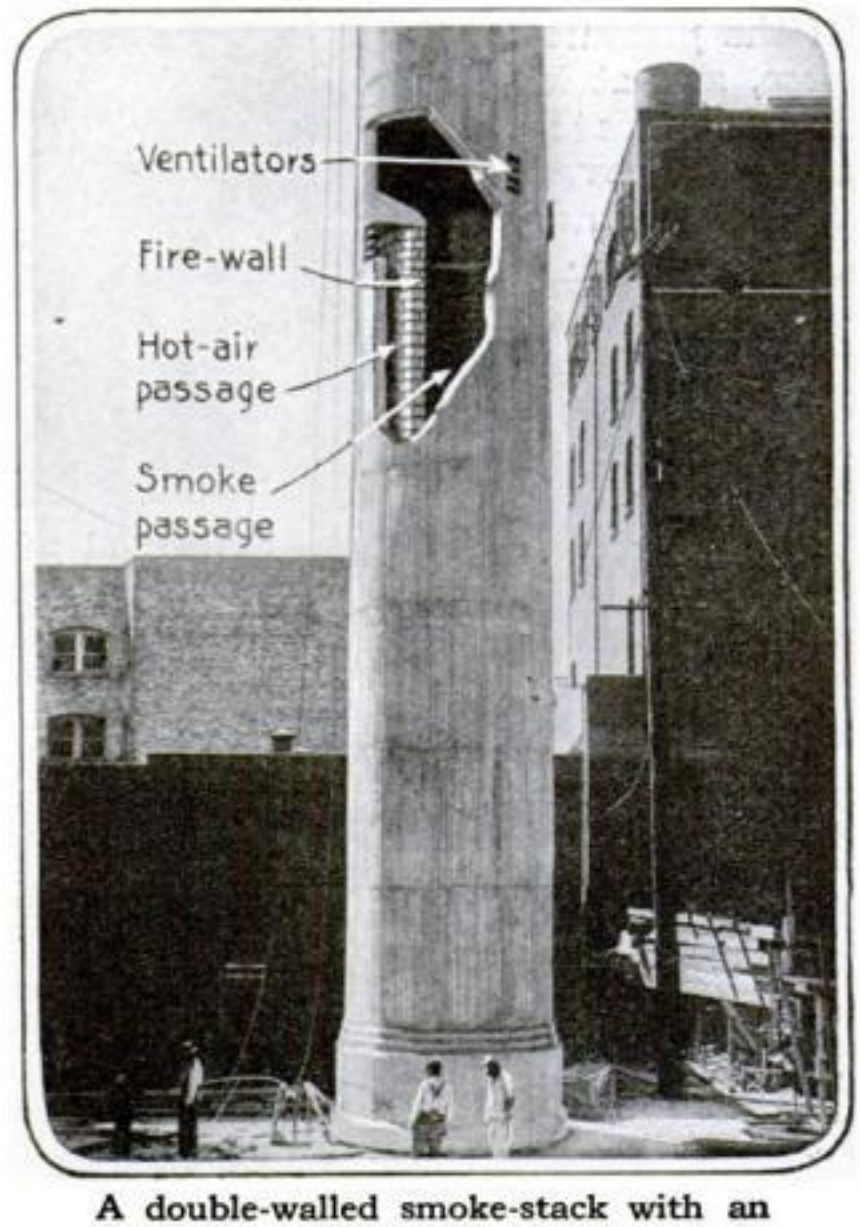
Carrying Off Smoke and Foul Air in the Same Smokestack

A DOUBLE-WALLED stack, which acts as a combined ventilator and smokestack, has been built in Los Angeles, California. The foul and hot air from the engine room enters at the bottom of the stack, passes up through a space between the outside concrete wall and an inner firebrick wall and out of ventilators. These ventilators resemble windows and are placed about half-way up the stack, at which point the ventilating section of the stack terminates.

In contracting the stack from a diameter of ten feet, six inches at the base to six feet, ten inches at the top, the sections were tapered in a novel manner. In the form were a number of tapering slats. The sections were made smaller and smaller by removing one slat from the form each time a section was laid.

The engine room likes the improvement. Almost always engine rooms are the most poorly ventilated regions in a whole building. We anticipate there'll be a big rush of engineers to Los Angeles, now that we've published this article.



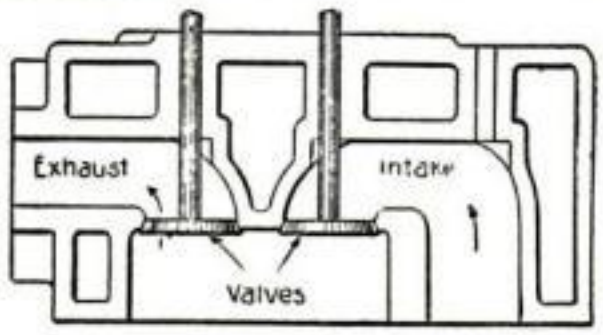
A double-walled smoke-stack with an inner compartment for smoke and an outer compartment for hot and foul air

Fifty-Seven Miles an Hour in a Ford!

ANY owner of an automobile with a detachable head motor—such as a Ford has—may increase the speed of his car from fifty to sixty per cent by means of a sixteen-valve-in-the-head cylinder attachment, shown in the accompanying illustrations. As much as fifty-seven miles an hour have been reached with a Ford.

No machine work is necessary to install the attachment. Although sixteen valves instead of eight are employed on the four-cylinder engine, the same valve push-rods are used. This is made possible by an ingenious lever arrangement on the top of the head. All the channels previously used for intake and exhaust are converted into intake passages alone; the area for the incoming gases is doubled and similarly those for the exhaust. By reason of this increase, and by placing the spark plug directly in the passage over the piston head instead of off to one side, as in the regular Ford L-head engine, the larger volume of gas is more quickly ignited and more thoroughly burned. Similarly, the burned gases are instantly released with but a very small back pressure, so that they are completely expelled before the admission of the next incoming charge.

Just how efficient such an attachment is, is not stated. Probably, it is chiefly of use on racing cars. Usually where gases are shot in and out of cylinders so rapidly a waste ensues. Wear on parts is also greater. Imagine a little Ford scrambling down a race track, this new attach-attachment on its engine! From under its hood comes a roar, the wheels whir, the fenders clatter, sundry parts threaten to leave themselves along the right-of-way. "Too much is enough," groans the Ford.



Showing exterior and details of the new sixteen-valve-in-head attachment for Ford motors

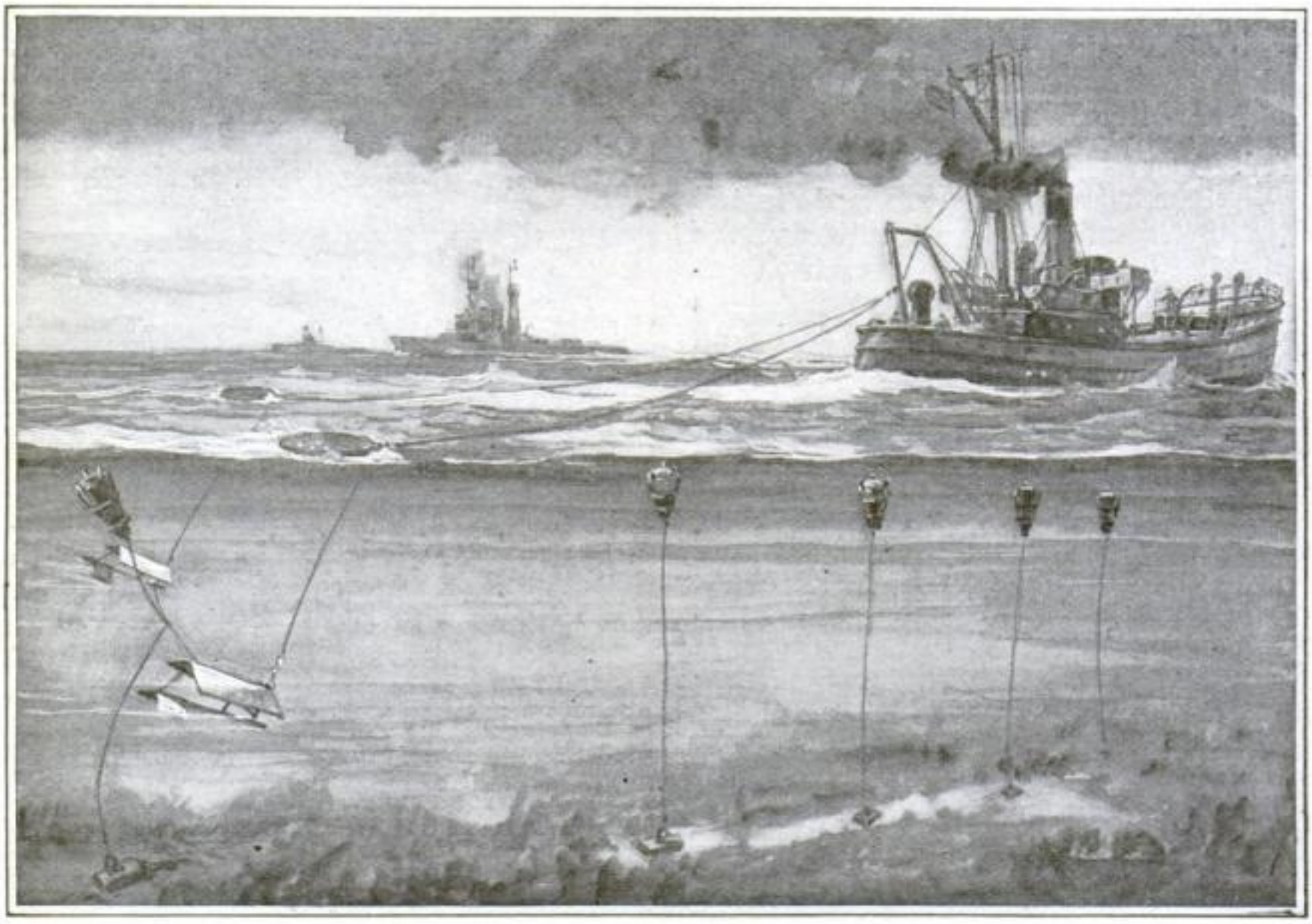
The physician has his hands free for the examination of his patient's mouth or eyes

He Holds the Light So That the Hands Are Free

SOMETIMES a doctor must examine the mouth, the throat, or the eyes in order to make a correct diagnosis. The ordinary electric pocket light is not convenient because in using it the doctor does not have the free use of his hands. Dr. Alfred Kahn, of New York University, has invented an ingenious light which the physician may hold in his mouth. The simple construction of this light, its triple ball bearings, its lightness of weight, and the fact that it can be bent around one finger or held by the fiber mouthpiece between the operator's teeth make it extremely useful to the general practitioner. Another advantage of the Kahn light is that it may be perfectly sterilized. Doctors especially like a lamp of this kind for emergency calls.

Safety-First in Mine-Sweeping

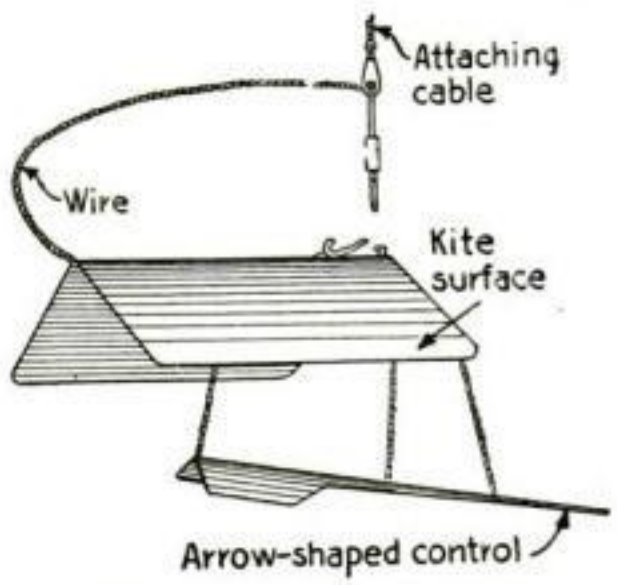
How it is secured with a recently invented Swedish under-water kite



The dangerous occupation of sweeping the sea for mines charged with from four hundred to nine hundred pounds of T. N. T. has been rendered less hazardous by the invention of an under-water kite which first gently touches a mine and signals to the officers on board the ship

DRAGGING the sea for mines, charged with from four hundred to nine hundred pounds of T. N. T. and liable to explode when a little glass tube of acid is broken, is probably the most dangerous occupation in which a brave man can engage. It has not even the redeeming feature of being romantically interesting. There is no chance to fight—only the chance to die an instantaneous death.

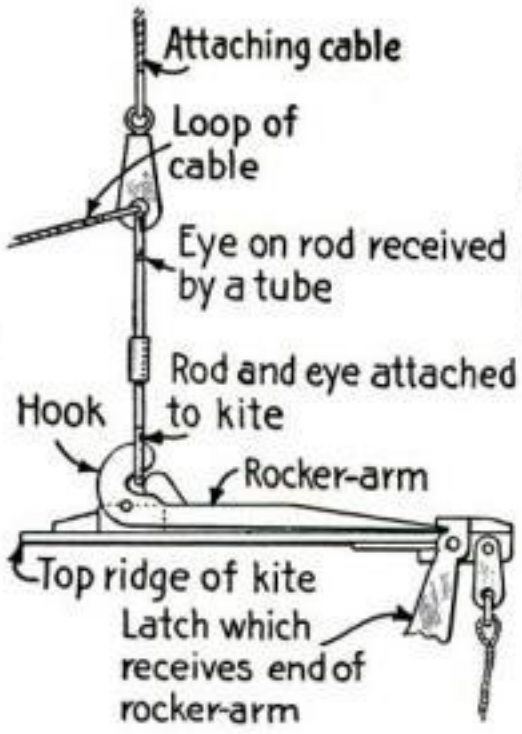
As might be supposed, the mine-sweeper drags the waters of the sea with a cable. But the cable alone is not enough. An auxiliary signaling device is also found necessary, something which will indicate the presence of a mine before the actual dragging begins. To this end, a Swedish tell-tale, recently invented, is employed in nearly every navy and particularly in the German navy.

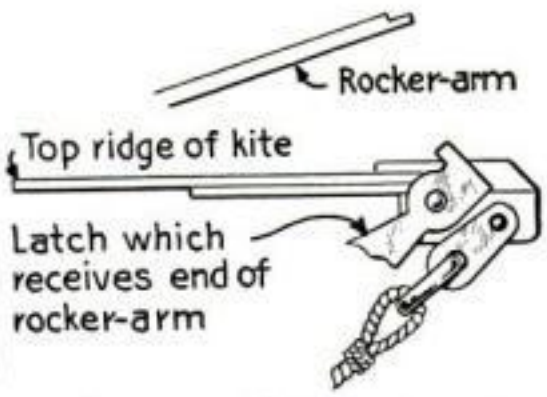


The Under-Water Kite and How It Works

Beneath the roof-shaped kite, an arrow-shaped control is suspended by three small wires. When the two forward wires of the arrow-shaped control release a latch by which the attaching cable is secured to the kite, a bell is rung on board the ship, indicating that the entire apparatus has come in contact with a mine to be removed.

The tell-tale may be described in a general way as an under-water kite which is dragged by means of a steel cable which is paid out from a drum on the stern of a vessel. As the ac-





Releasing Mechanism of the Under-Water Kite

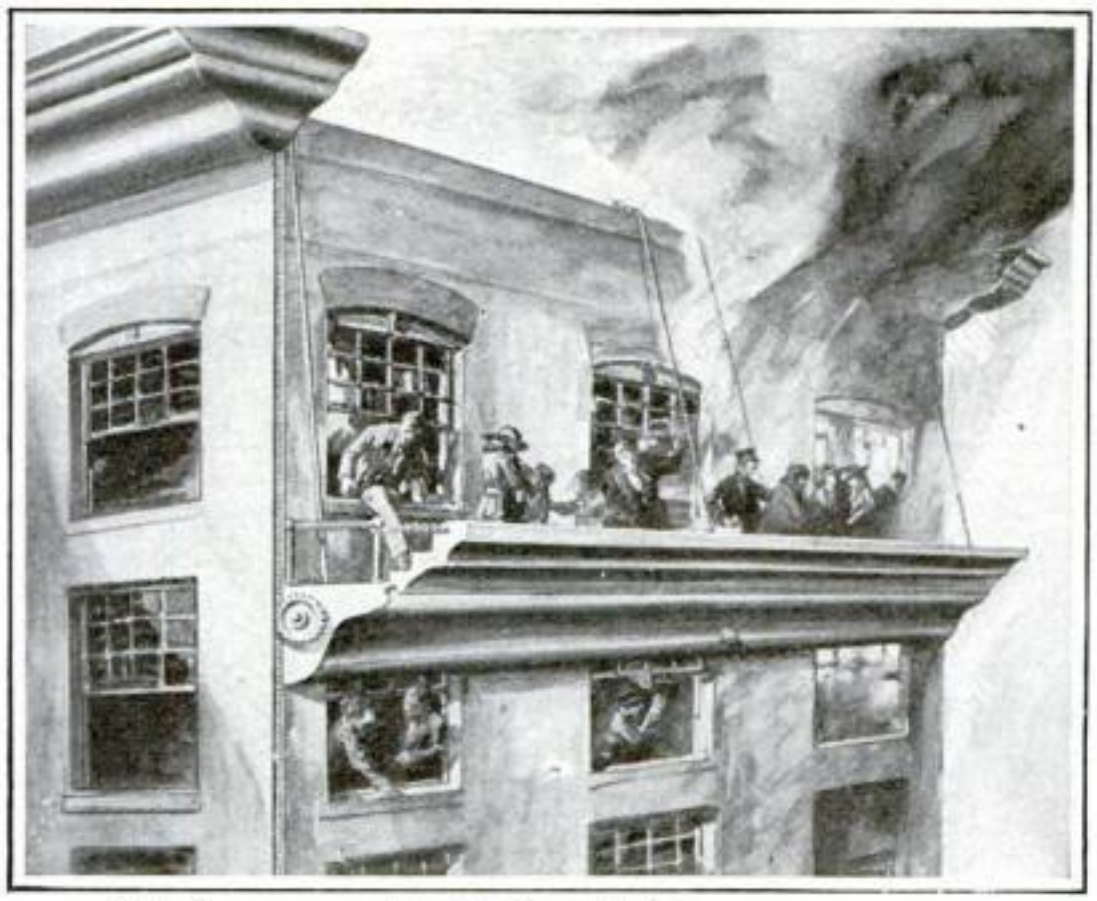
The hook of a rocker arm enters an eye in the end of a rod suspended from the attaching cable of the kite. When the arrow-shaped control strikes a mine, the latch by which the end of the rocker arm is held in place is released. Hence the hook is withdrawn from its eye and the attaching cable freed from the kite so that the kite is suspended only by the loop of cable. The sudden slackening of tension on the cable causes the bell on the ship to ring.

companying illustrations show, this under-water kite consists of two pieces of sheet metal joined together in the form of a common barn roof. Suspended below the under-water kite by three ropes, is an arrow-shaped control which is guided by a roof-shaped piece. If the arrow-shaped control should touch a mine, a latch by which the under-water kite is attached to its cable is released, a bell is rung on board the mine-sweeping vessel, and the officer in charge is at once warned that the tell-tale below is in contact with a mine to be removed. Very slowly and very carefully the vessel approaches the mine, raises it to the surface and then steams away again to a safe distance. Thereupon the mine becomes a mark for the gunners until it explodes, tossing to a height of three hundred feet, a great geyser of water. So terrible is the explosion that the effect is felt in the water within a quarter of a mile.

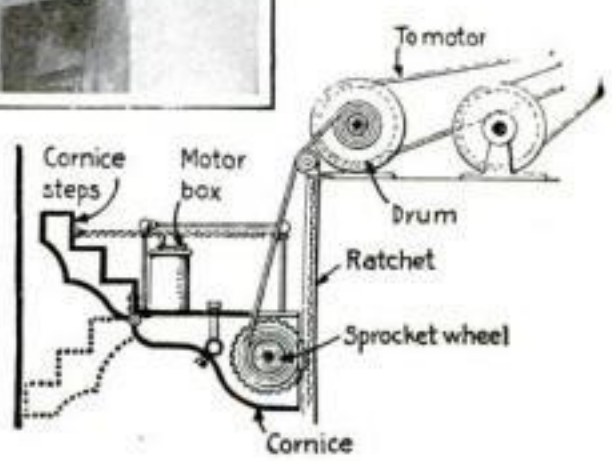
In Case of Fire, Take the Cornice Elevator

WHEN a fire occurs, why not use a cornice elevator instead of the usual fire-escape? Extending the entire width of the building, it could be lowered floor by floor, permitting persons to enter it through every window. Furthermore, a burning building could be emptied in one-half the time, and after the cornice elevator had discharged its human freight, it could be used by the firemen as a movable platform from which to fight the flames.

Such are the uses to which the fire-escape elevator may be put, according to the inventor, Bernhard Sussis, of New York City. In its usual position, it serves as the cornice of the building. The hoisting and lowering machinery which consists of steel cables and drums and an electric motor is all situated on the roof. The elevator is operated from a controlling lever on the platform, moving up and down against an upright pair of rack-bars attached to the side of the building. It is equipped with guard-rails, side-chains and steps. As shown in the illustration, it looks almost too ideal to be practical.



The fire-escape elevator is nothing more than the cornice of the building, raised and lowered in the same manner as an elevator

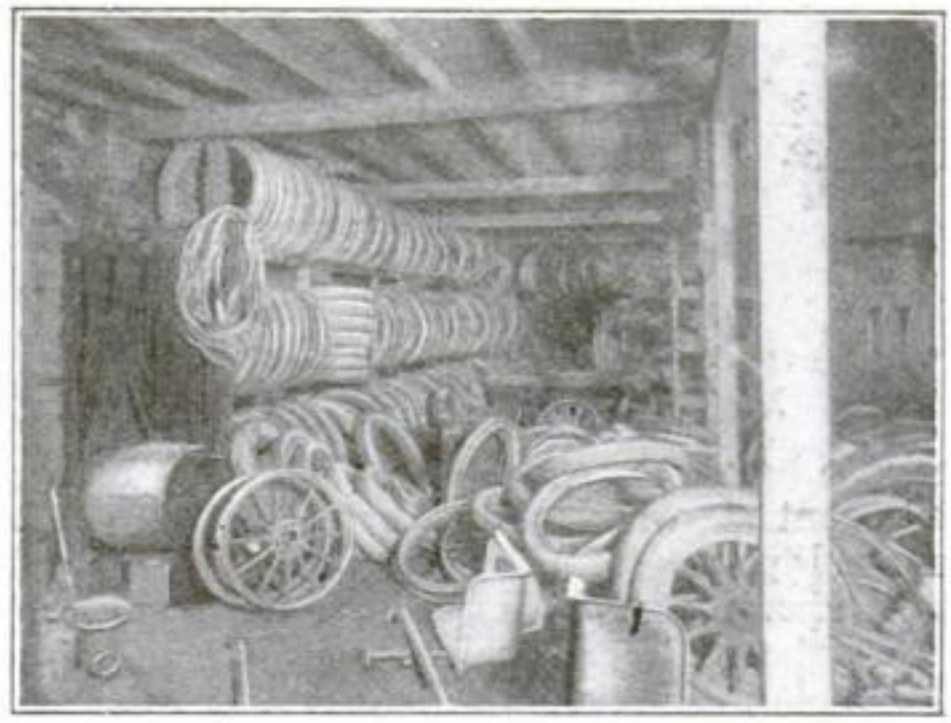


The Graveyard of Automobiles

How much is an automobile worth, not as a vehicle but as so much metal, hair, rubber and wood? The "junkie" knows.

SOME makes of cars have a large proportion of the rarer metals concealed within them; some have starting and lighting systems; some have magnetos; and some nothing. The "junkie" knows just what a rumbling scrap-heap is worth.

Hair from the cushions sells for fifteen cents a pound at present prices. Copper is worth twenty cents; aluminum twenty-two cents for cast, and thirty-five cents for sheet. Some cars do not have these ingredients; they are on the junkie blacklist. Lead comes chiefly from electrics, brass runs from fifty to one hundred pounds per car, aluminum from fifty to two hundred pounds and hair about twenty. "Iron," which includes all the alloys that look like iron, sells for only twenty-five cents a hundred pounds; their finer divisions into bearings, vanadium steel and other classifications the junkie leaves to the buyer.



Rubber tires and other rubber parts are valuable and are kept in separate piles

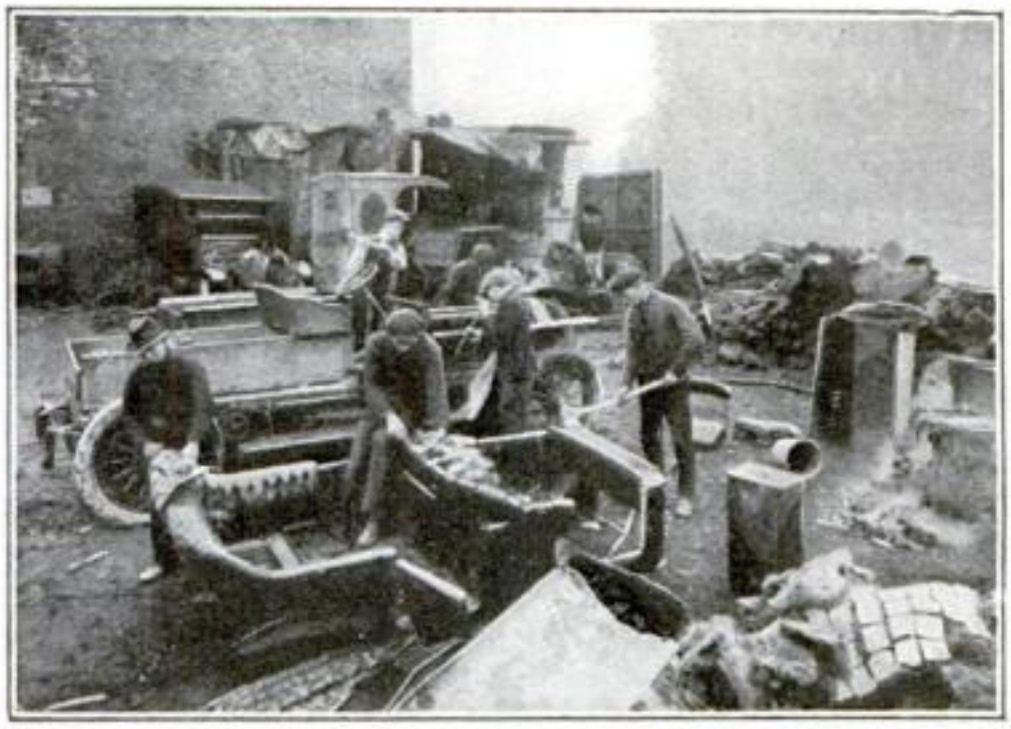
The junkie can tell you how many pounds of aluminum, hair and copper there should be in a 1906 Packard. He knows where he can use unbroken parts and he often has a standing order for certain parts of certain cars. These he is of course careful about.

In a well regulated junk shop the automobiles which have outlived their usefulness are dismembered and the most valuable parts sorted out and placed in separate piles or compartments. Wheels, tires, lamps, upholstered parts, glass, etc., go to their respective storage places, where they await their resurrection or transformation, as the case may be. Only such parts as are hopelessly irre-

The records of the machines which supplied the component fragments of this chaotic would make interesting and perhaps sensational reading. There is nothing pleasing

deemable are cast out upon the scrap heap or dump.

This general scrap pile, with its mass of broken and twisted chassis frames, axles, motors, wheels and what not, does not present a beautiful or cheerful picture. It is as a battlefield after a terrific battle, covered with the victims of the struggle. To think of the past glory of the racers and roadsters, limousines and runabouts, the dismembered parts of which now lie in a confused mass, rusting and rotting in every kind of weather, might inspire a poet to write an "Elegy of the Scrap Pile."



Upholstered parts contain horsehair, wool and other valuable material which may be used again

As a result of the higher prices paid for metals during the last year, there are now many junk organizations which buy a car too old to run or just able to wheeze, for from fifty to two hundred dollars, with no intention of ever letting the machine run another yard. By the time the parts are melted up you may find some of your old car in that new one you just bought.

mass of broken and tangled metal about the sight presented by this junk

The Open Grate Fires We Love Are Very Wasteful

THERE is something so cheerful and companionable in an open grate fire that even prosaic folk succumb to its charm. For many centuries, the open hearth or grate was the only means of heating dwellings during the inclement season, but times and conditions have changed and to-day grate fires are not taken seriously as a heating method. They still survive in that capacity in the somnolent backwoods and are preserved for ornamental or sentimental purposes even in modern apartments. But they have outlived their usefulness, and are doomed like other institutions of a remote past that do not fit into present conditions.

From a sentimental point of view open grate fires may be desirable, but practical and economical business sense must condemn them as the most wasteful and inefficient method of heating. This would hold true even under more favorable conditions, but in the present day, when the most stringent economy of fuel is obligatory, the continuance of open grate fires for the purpose of heating would mean criminal wastefulness.

Into the grate one puts fuel that has the power of producing a great deal of heat, but the useful heat obtained from the fuel by that method is extremely small. Most of the warmth produced goes up the chimney, with a large quantity of air from the room. This air is replaced by cold air drawn in through the cracks in the windward side of the house. Such a method of ventilating is altogether too expensive and wasteful. A stove would be far more economical, and to-day economy is the first consideration.

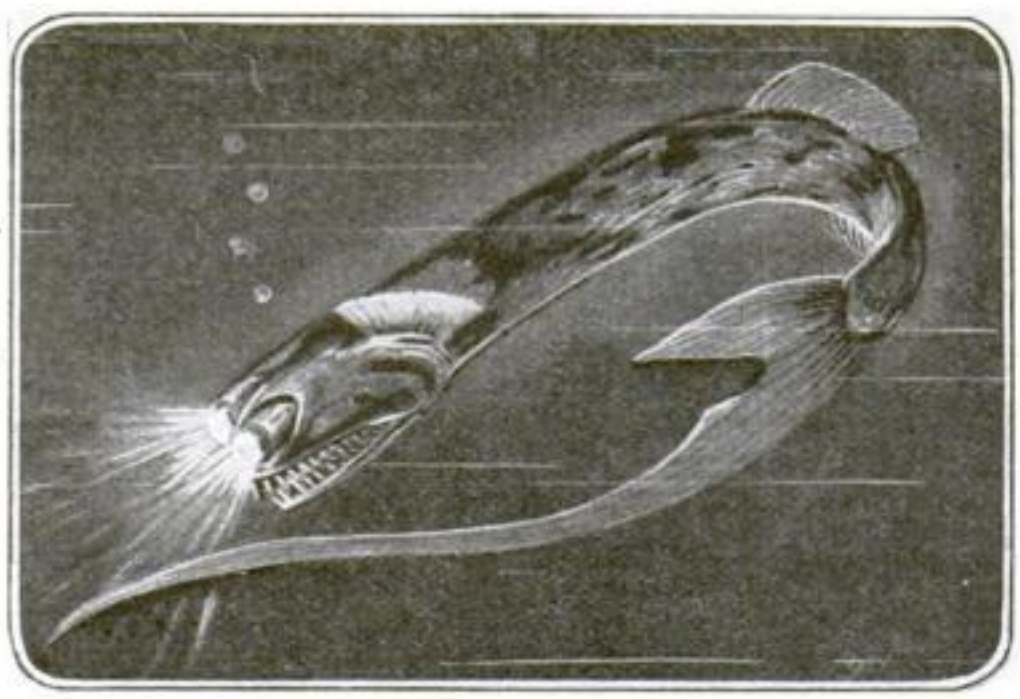
Deep-Sea Fish with Lanterns

Some fish carry their own power plants, searchlights, lenses and dimmers as if they were living automobiles

By Dr. E. Bade

Illustrations by the Author, supplied by Courtesy of American Museum of Natural History

DEEP-SEA fish have been strangely influenced by that total darkness in which they live. Their eyes have lost their responsiveness to light and are therefore practically sightless. These blind fish are the inhabitants of those profound depths into which not even an infinitesimal ray of light can penetrate. In fact the fish must live in perpetual darkness. The eyes of some deep-sea fish are tiny; the eyes of others are very large and round, as if they would catch some faint ray which may by some chance have penetrated these depths. But the most peculiar thing about the deep-sea fish is that approximately one fifth of them have developed some kind of a luminous organ, carried on this or that part of the body. Yes, even the whole body of some of the fish is illuminated, giving off to the surrounding water a faint iridescence as they glide along.

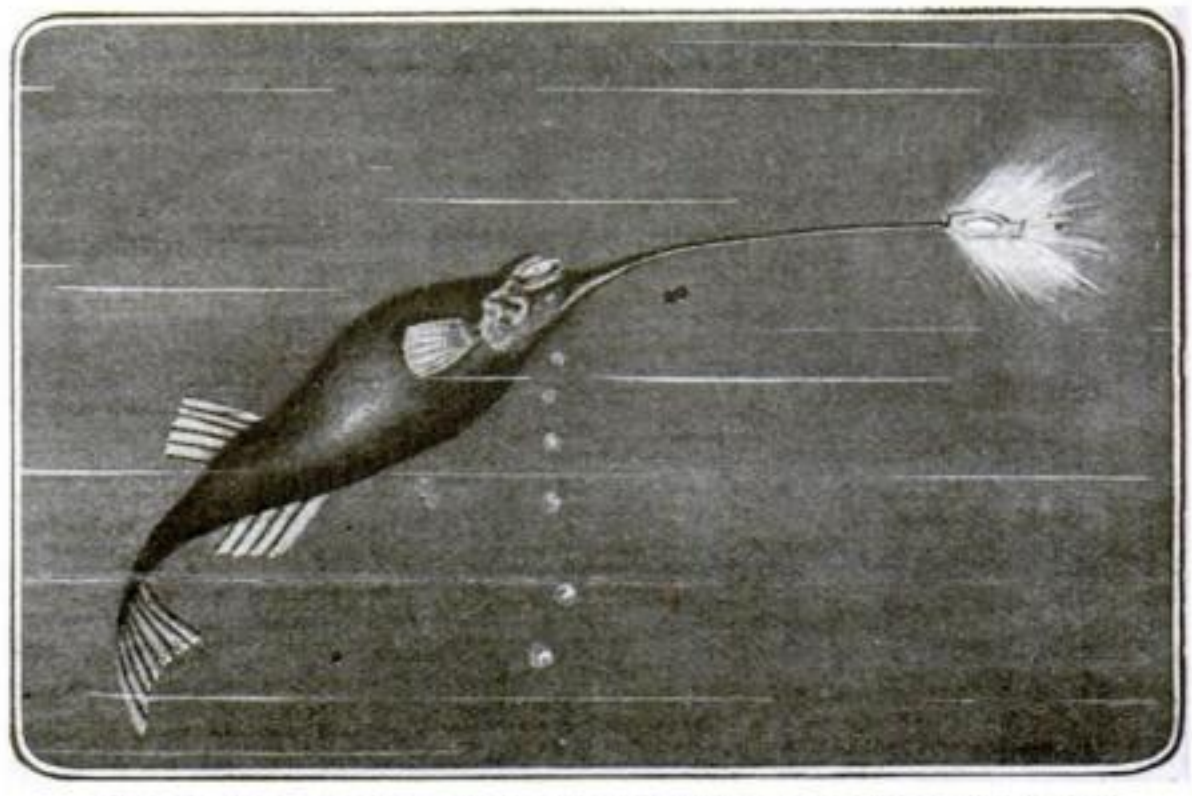


Some deep-sea fish are equipped with headlights which look very much like those on an automobile

It's Deep Where They Live

Such lights are found not only on deep-sea fish, but on some varieties that live in well-lighted parts of the ocean as well. Two small varieties, commonly called "lantern fish," inhabit the Malay archipelago about the Banda Islands. A third variety has recently been discovered near Jamaica. These three forms are the only ones upon whom the action of the organ of light can be observed under normal conditions. The large, luminous organ, situated just below the eye, emits a greenish-white light, which is not steady but which flickers rhythmically. By pushing or pulling a skin over this organ the fish prevents all rays from escaping outward.

The light-organs of deep-sea fish are similar in structure. They were in all

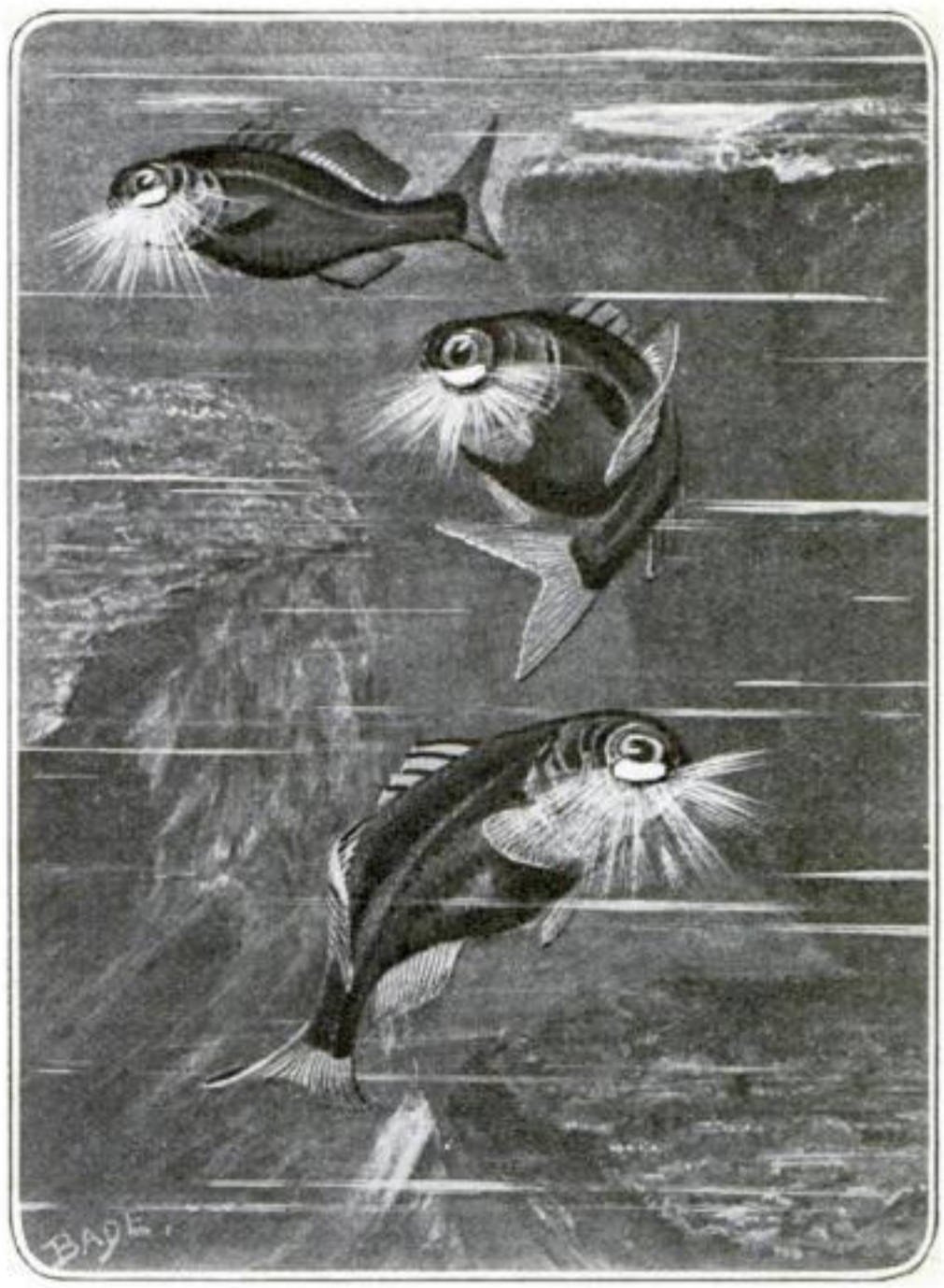


Other deep-sea fish have their bulbs, resembling portable electric lamps, attached to the tip of a long, movable stem

probability developed in zones of semi-darkness.

Glands Furnish Light

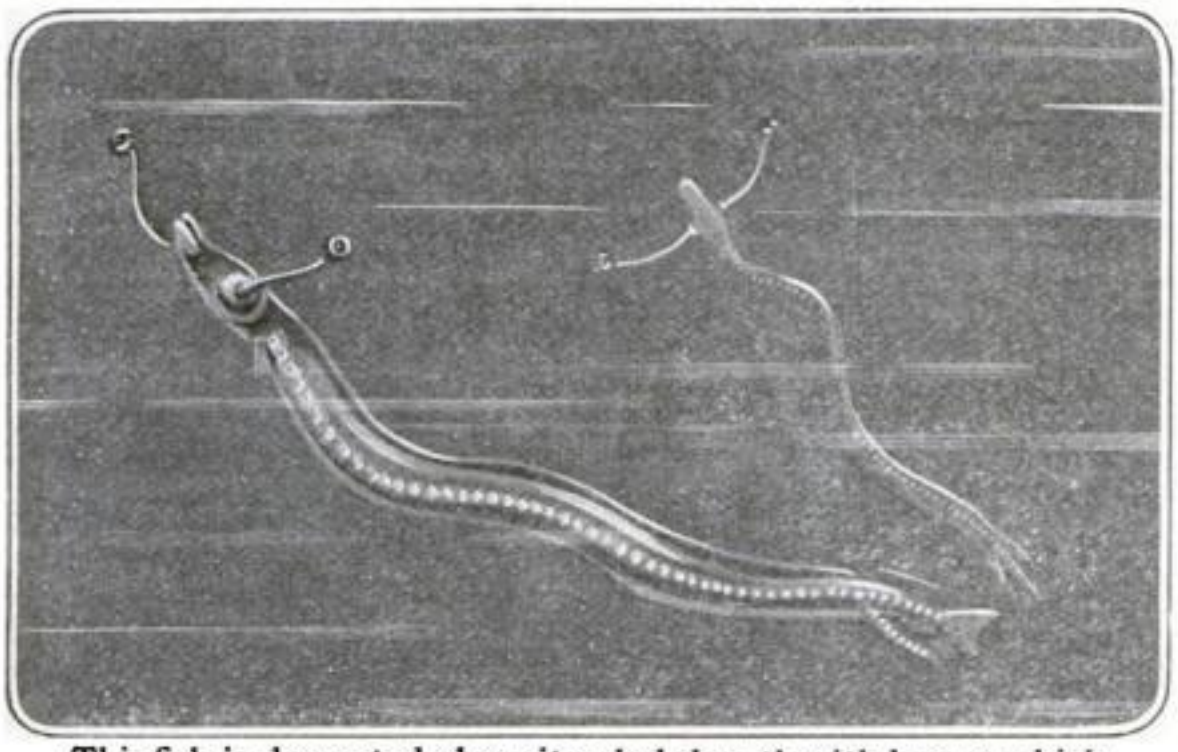
It makes no difference where these lamps may be found or on what part of the body they may be carried. All are evolved from glands. In its simplest form the gland is a sack, the walls of which give off a luminous substance which is ignited when it comes in contact with the water. The action is therefore chemical. On the other hand, some fish have an inclosed organ which is lighted up within the body. The construction of the organ is very complicated. First, there is a covering which prevents the light from entering the body. In front of this is a silvered or brightly colored reflector which acts as a searchlight, in that it tends to throw the light outward. Often there is a lens present to concentrate the light, thus making it seem much brighter. Besides all this, many fish have dimmers which can be used at will, so that they can prevent light from escaping outward.



A fish with fish "lamps" beneath the eyes. These eyes are large and round, but apparently almost sightless

They Look Like Moving Signs

In addition to the principal organ of light, many deep-sea fish have minor ones, often arranged symmetrically, forming many beautiful patterns which emit a varied colored light. The purpose of these is in all probability to distinguish one variety of fish from another and male from female. But the use of those organs of light which have reflectors, lenses and dimmers, can only be conjectured. Some are, undoubtedly, real lanterns used to illuminate dark surroundings; others, which are attached to the tip of a long, movable stem, and carried not at all unlike an electric bulb, may be used as decoys to lure in unwary prey; other organs again are of a protective nature, lighting up when the fish is attacked. All these organs emit a perfectly cold light—something that man has not yet invented.



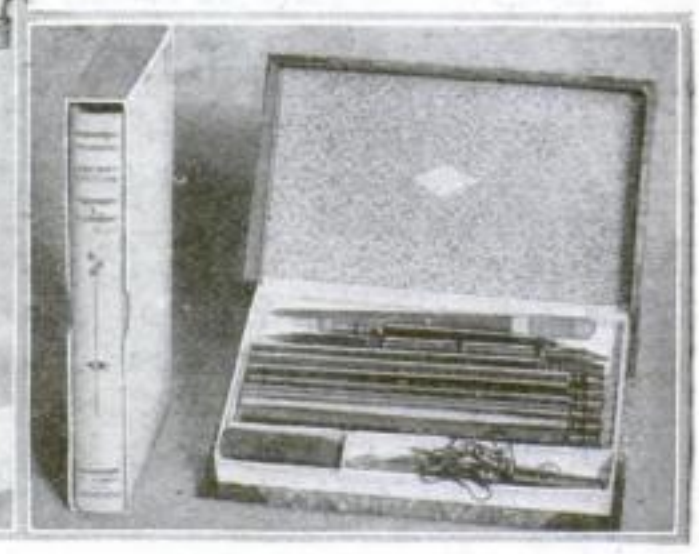
This fish is decorated along its whole length with lamps, which flash and dim like an electric sign which bids for notice

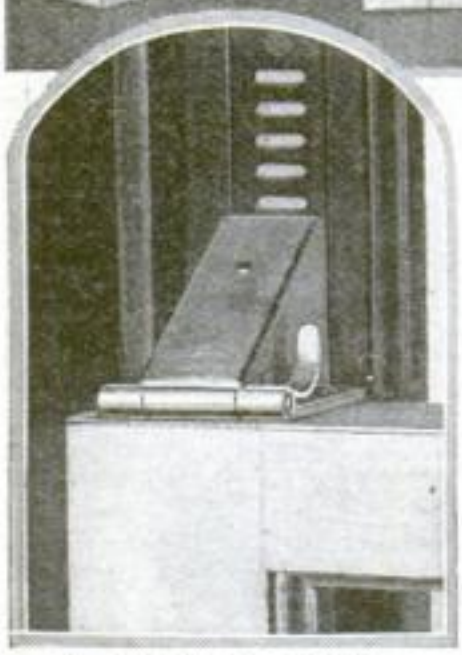
Housekeeping Made Easy

Novel twine-ball holder made of wood. The muff, of course, is the ball

Flusher which connects the faucet and sink opening to force out obstructions in drain

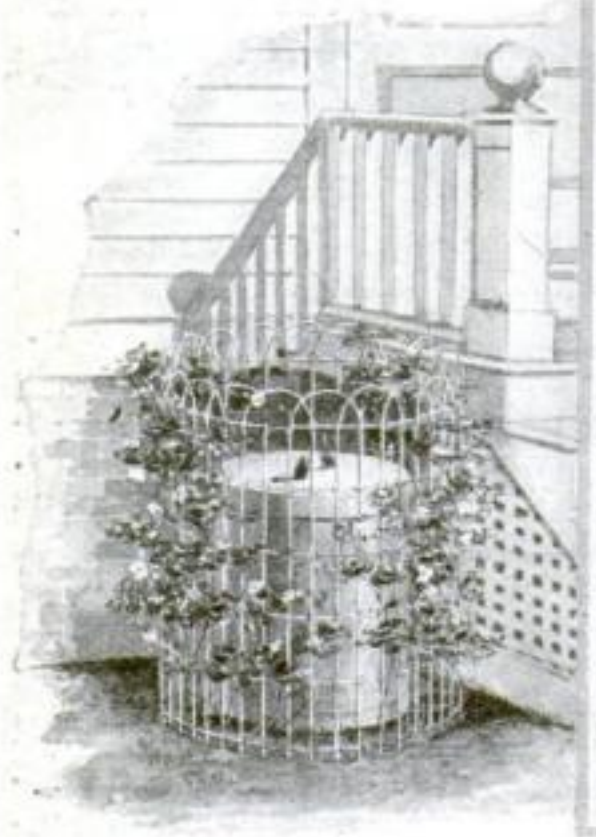
A pencil-case which will please the children. When closed, it looks like a book, and it can be conveniently carried to and from school



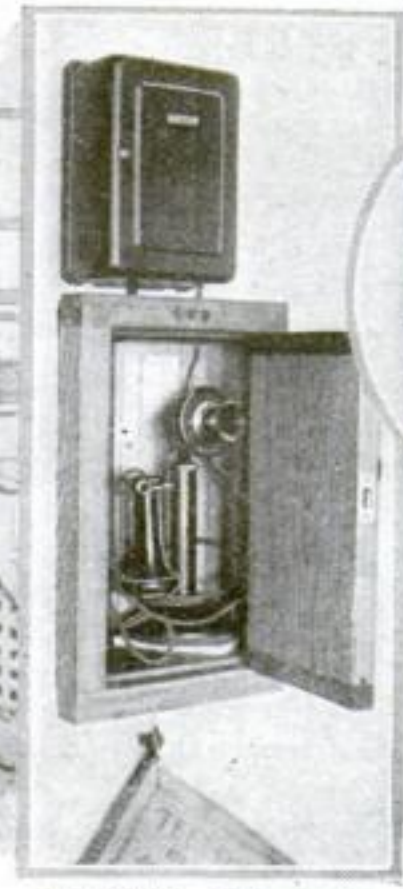


A locking device that holds the window-sash wherever it is set. It keeps out burglars or lets in sufficient air

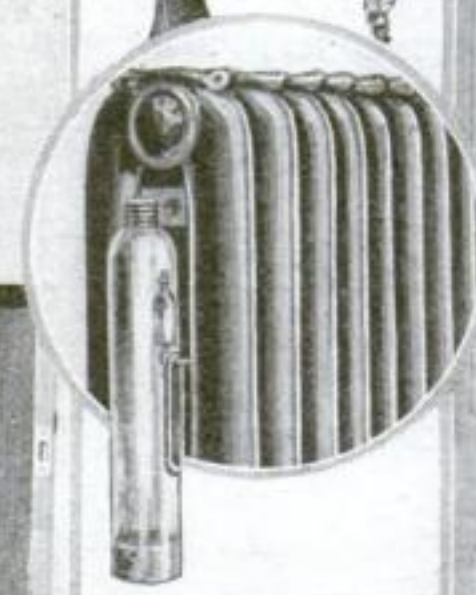
At right: A kitchen cabinet with a large flour bin which can be lowered and raised automatically



Ornamental guard for a garbage can. It hides the tin and it is dog-proof



Built-in telephone closet. Keeps out dust and saves space

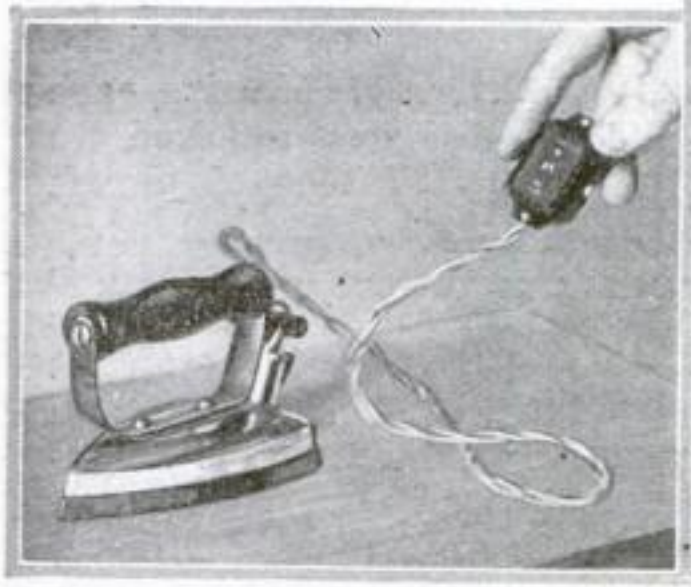


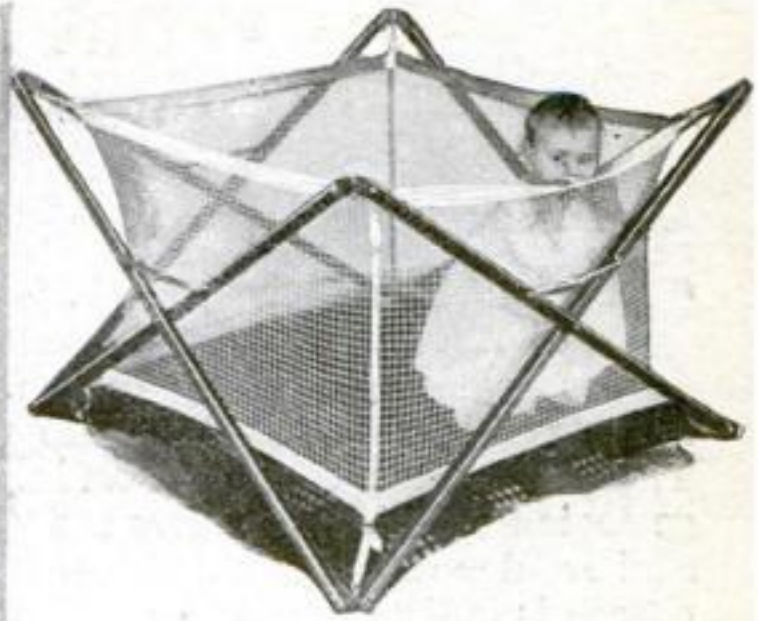
A catch-drip for the radiator vent. It also humidifies the rooms

An ornamental cover for a drinking glass which is used in the guest-room

Housekeeping Made Easy

New feed-through switch which can be attached to the flexible cord of an electric iron or other small electrical apparatus



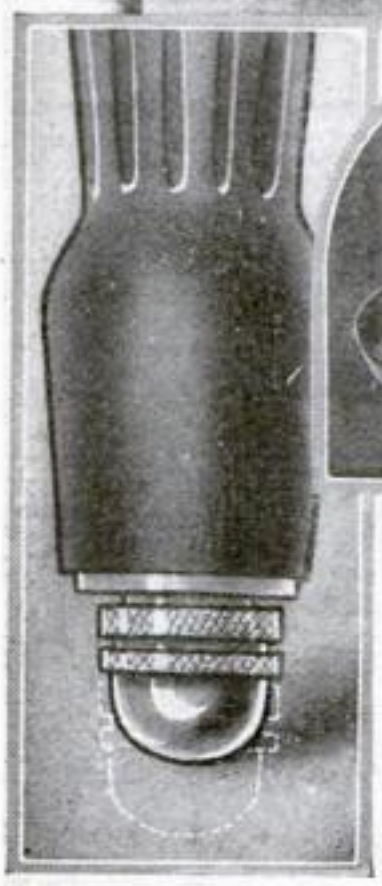


A play-yard that provides ample room for the baby. It can be folded away in a small space

Alarm for the hot-water boiler. A bell rings when the temperature reaches the desired heat

This new cedar chiffonier replaces the old fashioned cedar chest

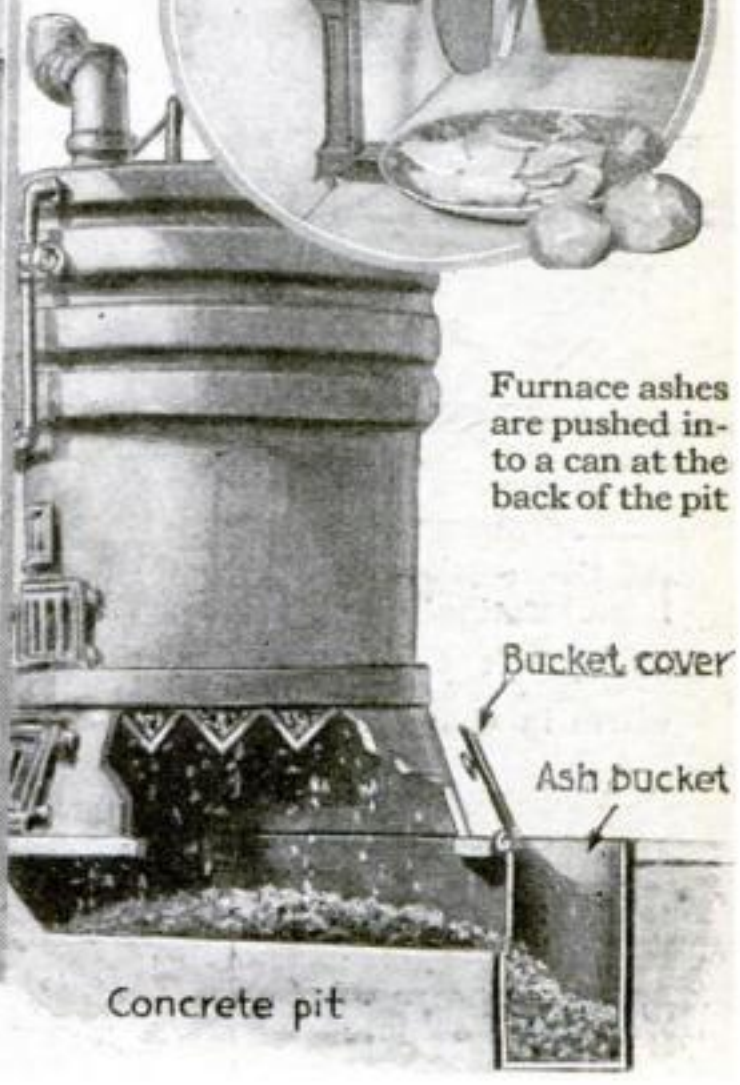
Below: A rotating cutter for fruit and vegetables. It slices them evenly



With this adjustable castor a table **cannot possibly tip**

Handle with a renewable wick, for greasing griddles, cake pans and muffin tins

Folding bed on a narrow truck fits **into a small closet**



Furnace ashes are pushed into a can at the back of the pit

What About Potash?

Talk about coal! Why, potash costs
$450 a ton and hard to get at that

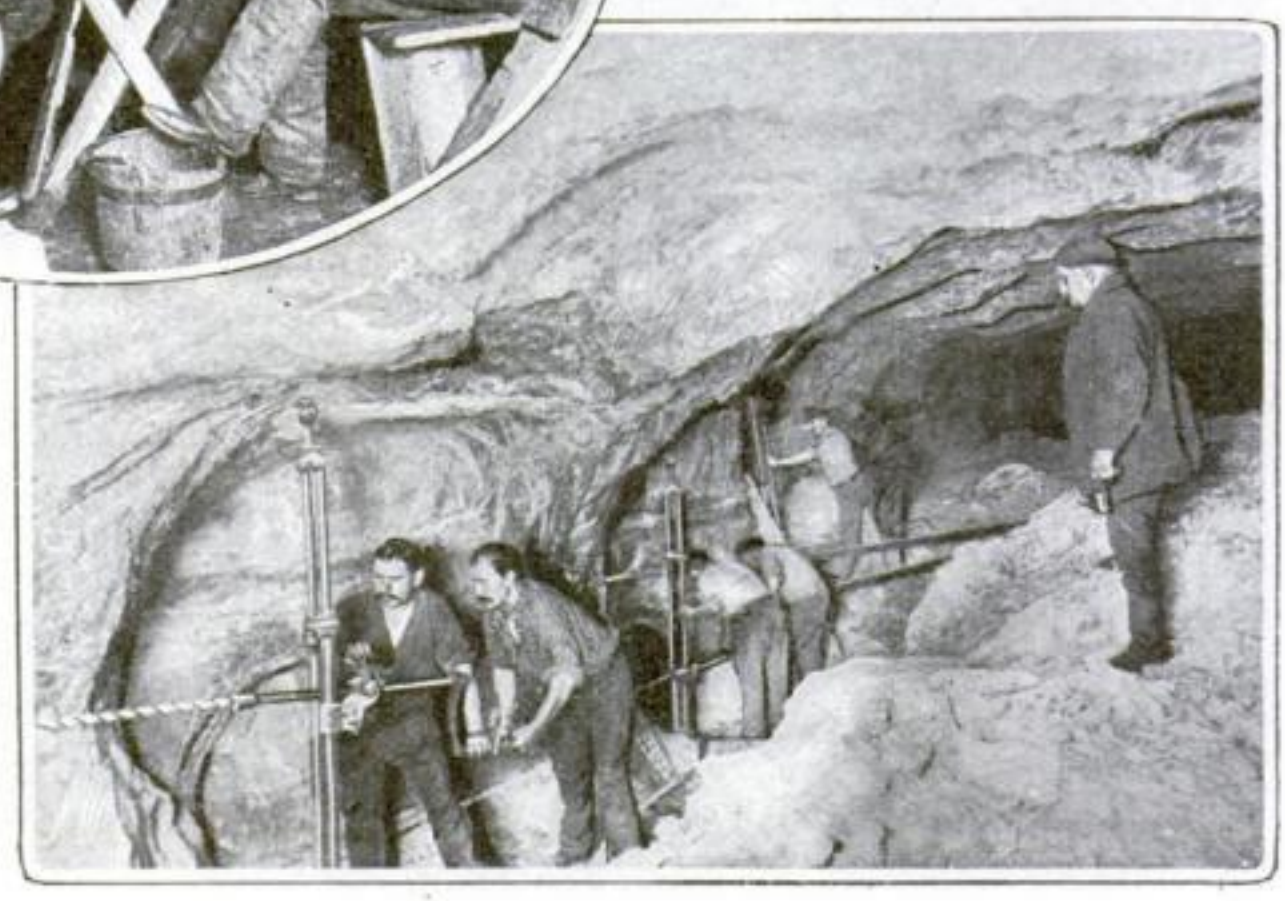
THE farmers of the United States and of other countries are dependent on Germany for cheap potash. Germany's famous potash beds are unique. These salt beds constitute an important geologic formation, for there are no other similar deposits in all the earth, and potash is indispensable to agriculture and industry.

In 1913, the year before the war, these mines produced close to 12,000,000 tons of crude potash salts, an amount sufficient to build a pyramid nearly twice the size of the famous pyramid of Cheops. At that time, this industry employed 2,200 officers and 40,000 laborers. It used 1,600 boilers, running 2,200 steam engines and developing 220,000 horse-power. The average daily output was 3,670 carloads of 10 tons each. A fleet of 258 ships, each carrying 4,000 tons, was required to transport the 1,032,127 tons of potash salts used in the United States in 1913.

The greatest chemical need of this country today is for potash. Besides being indispensable to growing crops, it has a multitude of uses in the arts and industries. It is essential to the manufacture of munitions, glass, matches, baking-powders, drugs, dye-stuffs, soap, antiseptics, and many other articles. Potash salts are used in the purification of water for municipal and industrial uses, in the metallurgy of gold, electroplating, processes of refrigeration and the commercial production of hydrogen for the inflation of balloons and Zeppelins. Photographers use it, so do painters, bleachers, weavers, dyers, paper makers, chemists, and many other artisans. Without caustic potash, Edison's famous storage cell would be impossible.

The known sources of potash in this country are pitifully small in comparison with the needs. The total of the much heralded supply in Searles Lake, California, will not exceed the output of the German mines

All the comforts of home! Eating lunch far underground in a potash mine somewhere in Germany



Hard at work. Germany's potash mines produce annually twelve million tons of crude ore, 40% pure

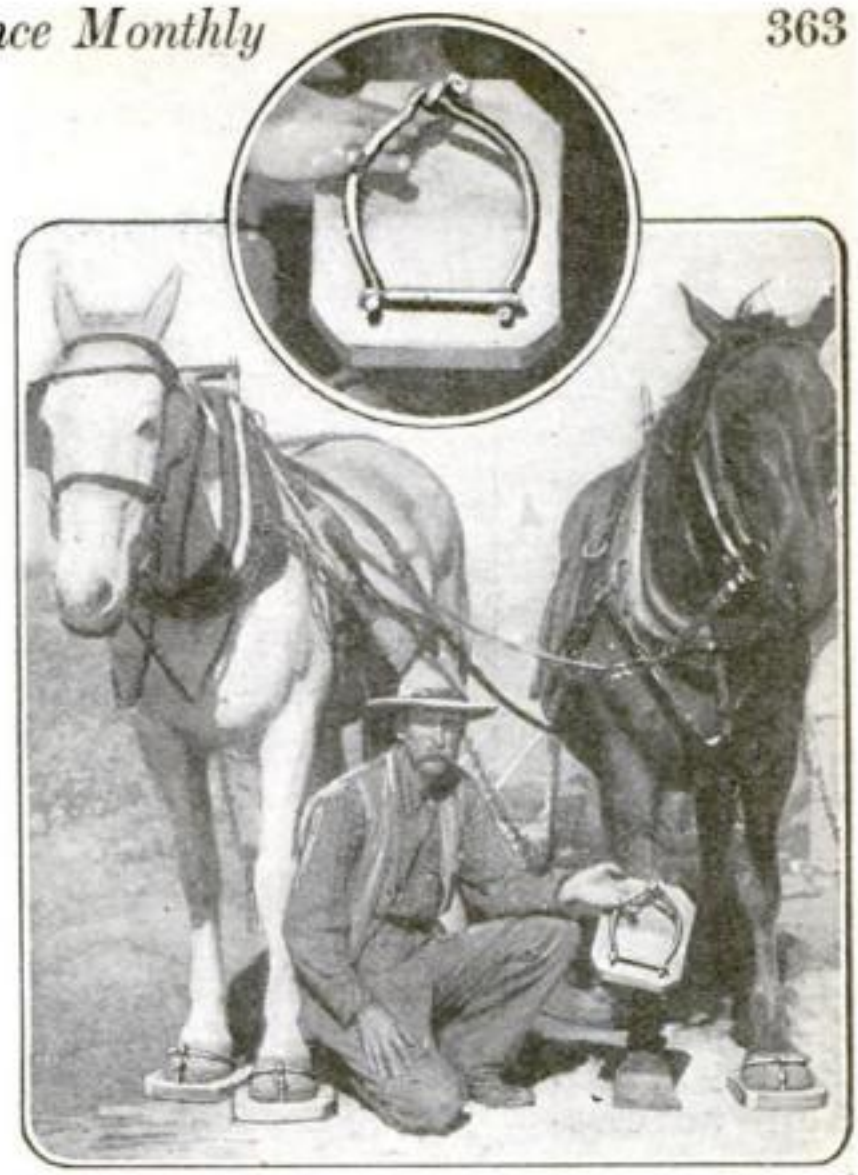
for a single year. Besides, the water of this lake contains, in solution, borax as well as potash, and the separation of the two salts is not simple. Borax, being alkaline, renders potash objectionable to agriculture and useless in industries. There are a few other sources of potash. Sea-kelp yields a small amount; the alunite deposits in Utah contain potash salts of alumina, but no soluble potash; the cement works are producing a little; some is contained in the refuse from the beet sugar refineries; but outside of Germany, the total annual output of potash is not over 50,000 tons as against 12,000,000 tons of the crude ore running from 30 to 40 per cent. of pure potash, produced in Germany each year. Since the embargo of January, 1915, the price of potash has risen from $30 per ton to $450 for the same amount.

A Gasoline Engine Used to Load Sugar Cane

THE old problem of handling a large sugar-cane crop soon after it has been cut, and before the cane dries and its sugar evaporates, has been well solved on a Louisiana plantation. A gasoline engine power outfit is utilized for this work and does it at a fraction of the cost of man labor, and more quickly.

Suitable grabs and hoists pick up the cane from the small heaps into which the cutters have dropped it, and swing it over to be tripped off into a wagon box. The wagons are provided with slings to unload the cane at the mill or at the field railway by the use of power hoists. Power machinery is much slower to invade the agricultural regions of the South than it has been in the North. But the waste and inefficiency of hand methods must give way before the present need for rapid harvests.

Suitable hoists lift the fresh sugar cane from the small heaps and swing it into the waiting wagon



If it weren't for these boards the horses would sink into the peat quagmires of southern California

Mount Horses on Boards. Then they Can't Sink Into the Mud

OUT in the fertile peat fields of southern California, the heavy draft-horse would be useless for plowing and cultivating, but for a wooden shoe, which was invented by some ingenious rancher, and which can be quickly clamped on the horses' hoofs. With his wooden shoes, the horse can walk safely on a surface of peat that quivers like jelly with his weight.

The shoes must be adjusted to suit the habit of the horse. If he has a tendency to knock his feet together, they must be trimmed off on the sides, although it is obviously best to have them as wide as possible. They are clamped on by means of small iron rods, curved to fit the hoof.

Let 'Em Come—This Outpost Will Account for Itself

IT is innocent-looking country, isn't it—that shown in the illustration on the right? Might be New Jersey flats, or a section of Northern Indiana, or a piece of Middle-western prairie. Yet a few hundred yards off toward the horizon are the enemy lines, and the Germans are in them. The country isn't as benevolent-looking or as calm and peaceful as it seems. Such outposts as this may soon be occupied by our boys in great number. Because the country is flat, a machine gun is effective over a wide area.

© Kadel and Herbert

A French outpost close to the German lines. Mud-soaked sandbags form the low parapet

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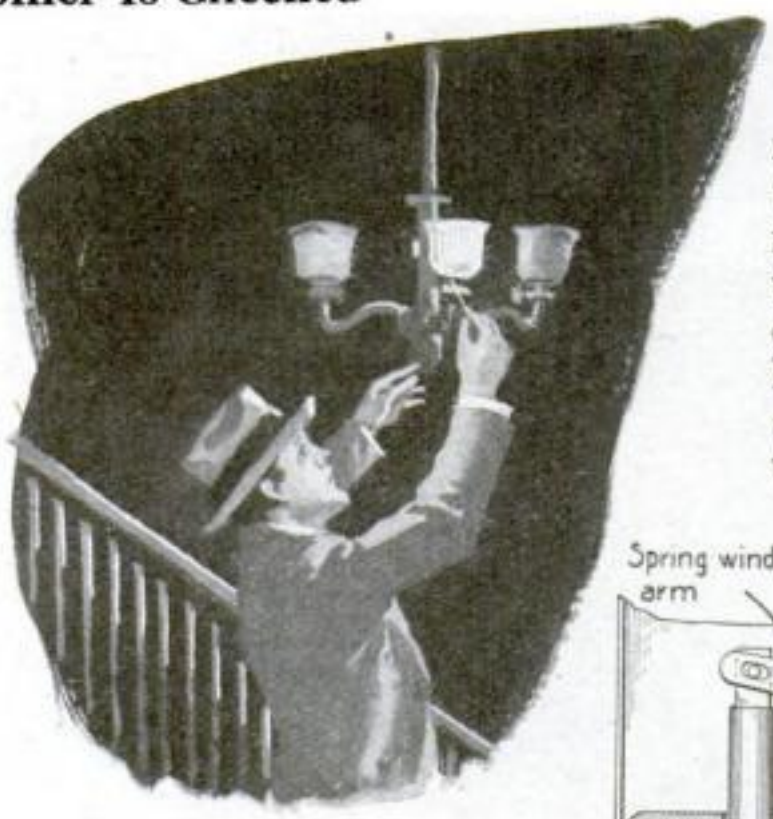
Weep No More, Landladies. The Light-Wasting Roomer Is Checked

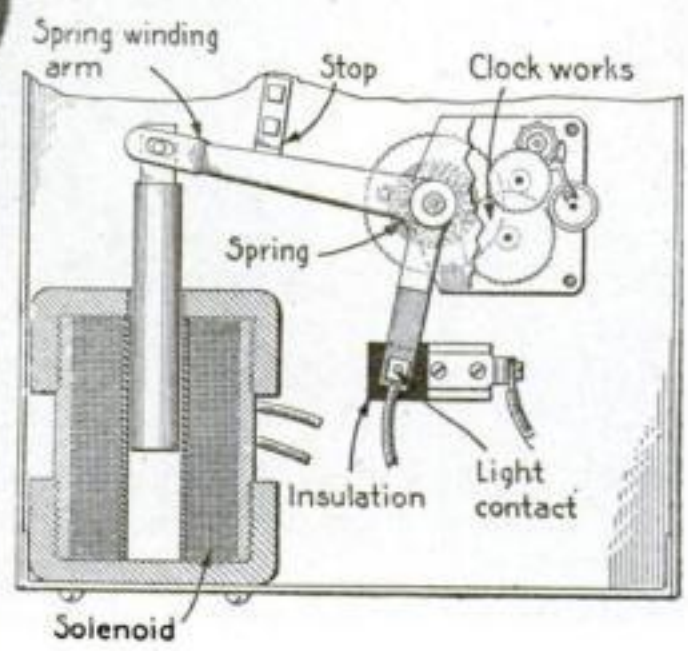
THE reason landladies are wary about having lights in the halls is, of course, that it costs money to burn lights. Now John H. Jordan, of Scranton, Pa., would come to the rescue. Landladies need worry no longer about what the meter is doing. Moreover roomers may have light any time they want it.

The how of his plan is this. The contrivance consists in part of an electromagnet connected in series with a push-button lamp-switch. When the roomer comes in and pushes the button, this electromagnet pulls down a lever. The lever winds up a coil spring. The coil spring runs a clockwork. The clockwork runs until the spring is unwound again, meanwhile permitting the lever slowly to move back to its old position. This takes about three minutes, and during that interval a switch, mounted at the lower end of the lever, has been "on." This switch caused the electric lights to light, and the three-minute interval they stay lit is sufficient for the roomer to get upstairs or wherever else he is going. Simple, isn't it? The landlady knows that the roomer will have to get up at three-minute intervals and punch that switch if the hall light stays lighted permanently. This is unlikely. Therefore she rests in peace.

The contrivance may may be applied equally well to attic or basement lights. Forgetting to turn these off is a common habit and a machine that will do it automatically saves on the monthly lighting bill. Closets and storerooms also need the device.



No longer need the roomer come in and fumble for the socket this way. He simply pushes a button in the wall. The lamp is lighted for just three minutes. The push button energizes the solenoid. It pulls down the core, winding the spring, closing the lamp circuit. It later opens



Fighting Off Aviators with Shotguns

The sawed-off shotgun of the under world is gaining laurels in a new field

UNCLE SAM has decided that the shotgun is, under some conditions, as deadly as the machine gun, and his Chief Signal Officer has ordered that instruction in the use of the shotgun be given at every one of the sixteen aviation schools now running, or about to be established.

When war started, the aviator used to go up merely to scout. He took along a rifle and a revolver or automatic pistol. But he could do no harm with such weapons in an aerial combat.

Then came the light machine gun, and the start of real aerial warfare. Now the air fight is merely part of the game, nor is the report of the week's doings complete without mention of the fact that the side making the report lost three planes and the other fellows thirty.

Also, there is the fast increasing use of the plane in sudden swoops over the enemy trenches; the machines, although they fly low, travel so fast that they cannot be hit with any certainty. Here, at short range, the five shots from the automatic shotgun would prove more efficient than charges from the machine gun, because the machine gun fire is concentrated while the buckshot scatters. And of course, there is also the use of the shotgun against the opposing plane at close quarters, where the action is too fast for swinging the machine gun to bear.

Buckshot varies in size from the tiny pellet running twenty-seven to the ounce of weight, to the sort running only nine to the ounce. Usually but an ounce of shot is loaded for the 12-bore gun, and the powder charge is three and a fourth drams.

For use against men at short range—less than fifty yards—the small size would be indicated. While it might not prove fatal in most instances, a few loads of this sort of pill would put the recipients in the hospital.

Number One Buck is just the size of the army bullet, .30 inch across, and weighs forty grains per pellet. Twelve pellets make an ounce and therefore the load.

The big, single, round bullet used in shotguns is another sort of missile that might well prove efficient in the hands of our aviators. Nothing shot out of a military rifle—outside of the rifle grenade—gives the tremendous shock and blow of the big .70 calibre, five hundred grain, round lead bullet that is used in the 12-gage shotgun. More than twice the size of the service rifle .30 calibre bullet, more than three times as heavy, and with a tendency to flatten out and hit still harder, the single ball for the shotgun, while not high in accuracy, is capable of knocking a man flat on his back if it hits him fairly. Five such huge pills, slung rapidly into an opposing aircraft, at a range of one hundred yards or less, would be like throwing five half-bricks into the machine with the velocity a half-brick never attained in this world.

What a Shotgun Will Do

At ninety feet all but one of the pellets bunched themselves well into the midriff section of a man-size figure fired at. At one hundred and fifty feet, seven out of the twelve hit the figure. At three hundred feet one shot missed the figure, two other shots put two pellets each into the figure, which is a disabling blow.

A party which was persuaded to go joy-riding through a coal mine in a Ford. The trip was a great success

What Won't a Ford Do If Properly Coaxed?

THE Ford's latest performance is turning mole and going grubbing in a coal mine. Dr. David Roy Nelson was the pioneer who coaxed his car into the Monarch Mine, at Monarch, Wyoming, and then had it photographed standing in the "Great Black Way."

When Your Clothes Catch Fire

KEENLY realizing and sympathizing with the world-wide demand for some really efficient but simple fire-extinguishing apparatus which can be placed within reach of people who carelessly allow their clothing to come in contact with flame, James O'Loughlin has devised and patented an arrangement which resembles a portable shower-bath. As the apparatus has not yet been placed upon the market, we are not prepared to publish warm testimonials from highly satisfied and more or less scorched customers.

The apparatus consists of three hollow perforated rings, connected by means of a flexible hose to a convenient kitchen faucet. To the smaller ring is fastened an asbestos curtain or garment and hood which is intended to envelop the body. The entire apparatus is collapsible, and when not in use is stored away in a cabinet fastened to the kitchen wall.

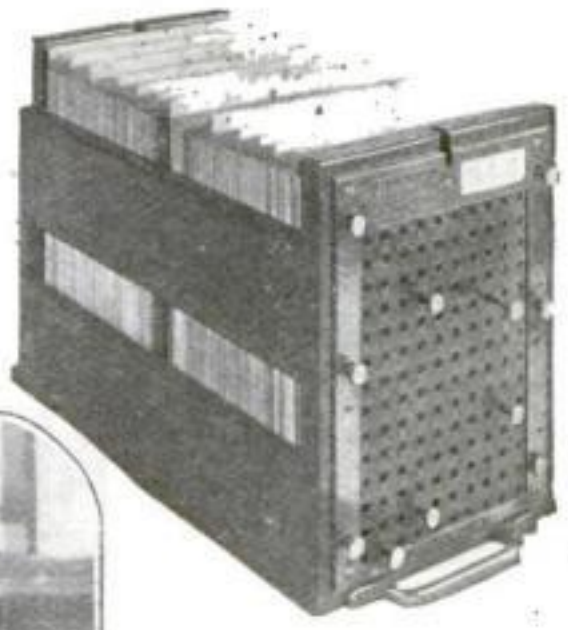
Here is the advice that Mr. O'Loughlin would have you follow when your clothes catch fire:

Go at once to the extinguisher cabinet. Pay no attention to your burning garment. In fact let it burn with impunity. If you have time, sneer at the flames in contempt! Press the release button of the cabinet. The doors open. Remove the perforated rings. This automatically starts the flow of water. Place the large ring on the floor with its perforations facing upward. This is very important. Stand yourself in the center of the ring. Whatever the flames have been doing in the meantime does not matter. This invention is not concerned with the action of fire, but only with the method of extinguishing it. It is important to keep your mind on the task at hand; otherwise you may find it necessary to allow the fire to burn itself out, which would not be quite as enjoyable as bathing it out. The smaller ring to which is attached the hood and cloak is thrust over the head and to rests on the shoulders. The cloak now unfurls and drops over the ring on the floor.

If you're on fire connect yourself with the faucet

Selecting Men Made Easy

Here is a self-thinking file that picks those wanted automatically

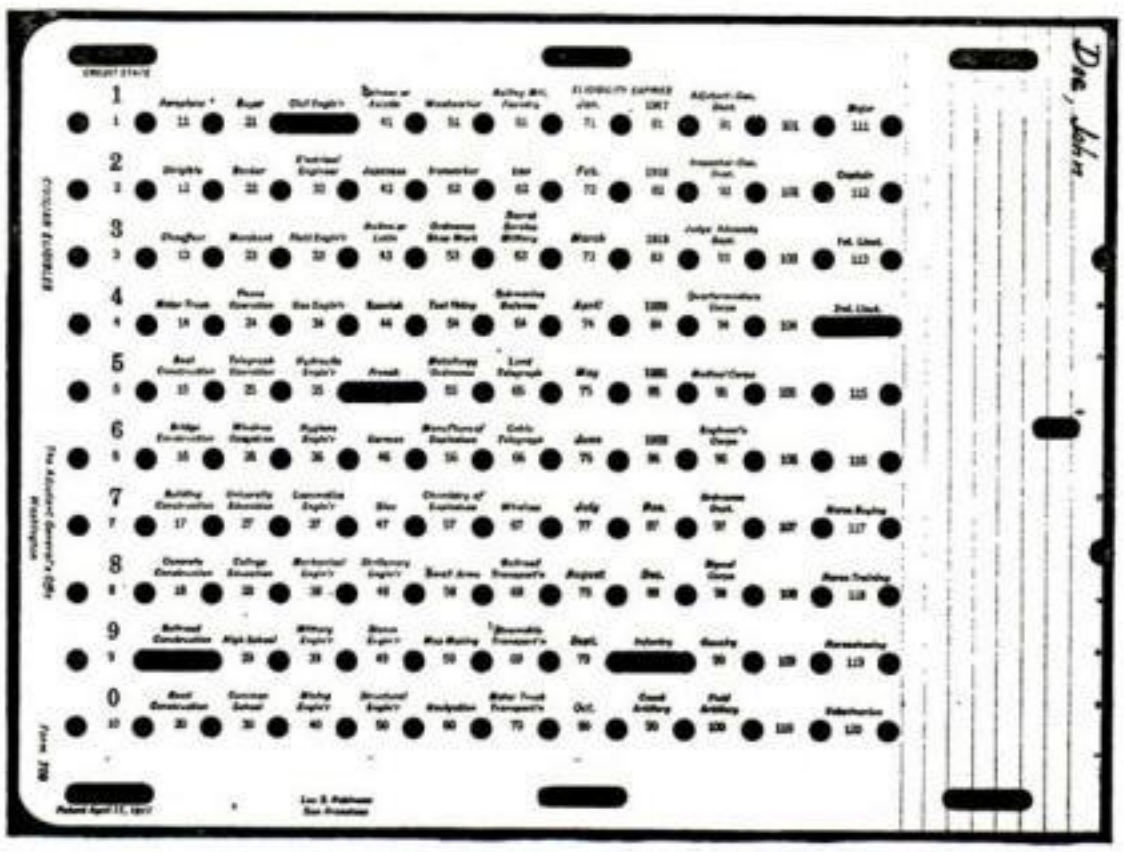


The file case does not differ in appearance from the ordinary kind

THE experience of England and France early in the war clearly proved the importance of keeping a detailed and intelligently indexed record of every man in the army and navy and their auxiliary branches. It also showed the need of a system that would make the grouping of the men, according to certain qualifications, a simple, possibly automatic, process.

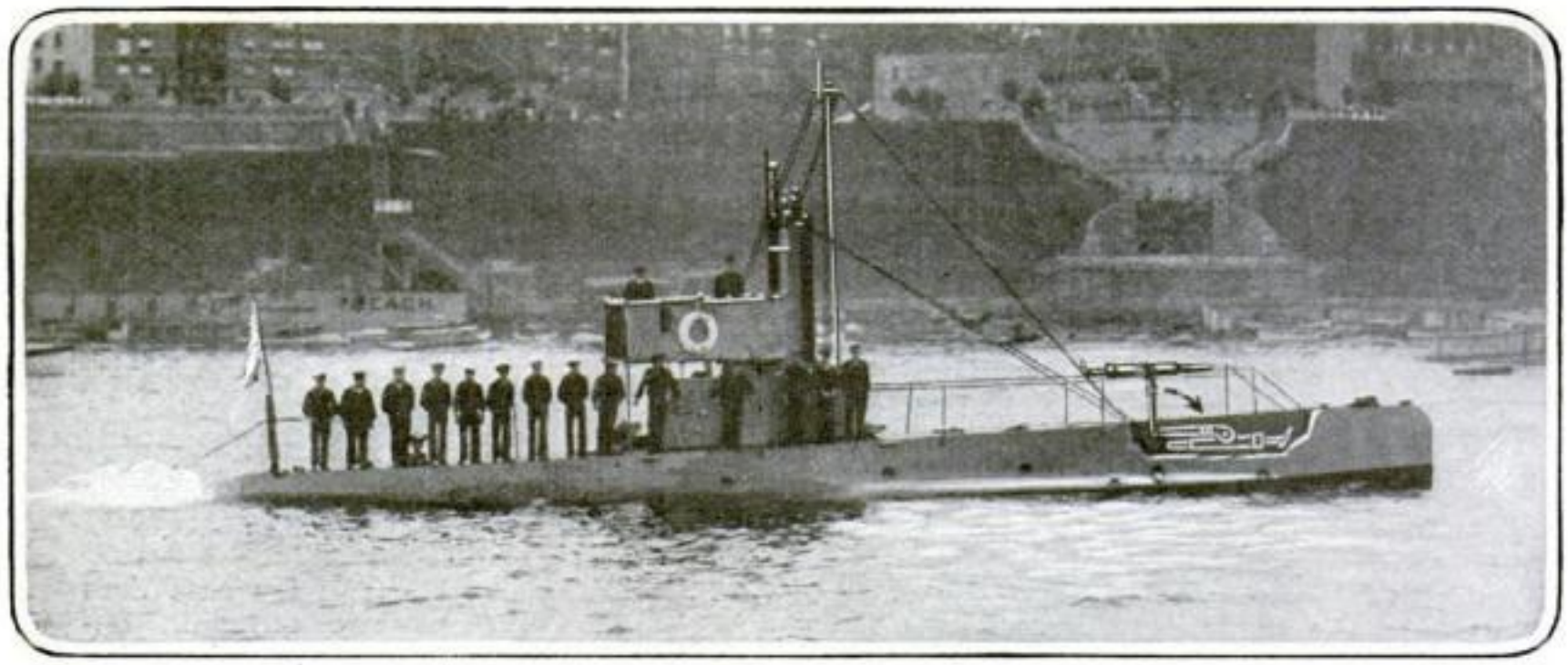
Above is shown the front of the file case with the rods inserted for making a selection

Such a system is offered by a file called the Findex, which promises to save the American government from the difficulties experienced by her allies. The device consists of a file case containing rectangular index cards. These cards have a space for the name of the soldier at the top, while in the lower part there is a system of round holes, arranged in horizontal and vertical rows. Each hole represents some particular information concerning the subject of the card, which it may be desirable to put on record. The items represented by such holes include for instance the previous civilian occupation, military experience, knowledge of languages or expertness in some profession or trade. To indicate that the subject of the card possesses a certain qualification, the space between the holes corresponding with the respective index number is punched out, thus making an oblong slot.

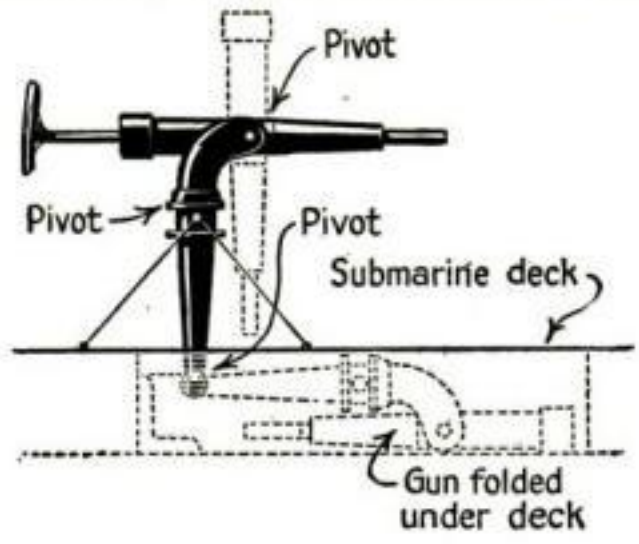


This is a reproduction of an index card. Each hole represents a detail of information about some soldier

Suppose that the Government wanted to select a corps of railroad engineers. A clerk inserts five rods through holes in the front of the case, numbered to correspond with the holes in the cards, indicating the particular qualifications desired. Then the whole file, case and all, is turned upside down on the table. All of the cards not having the slots to indicate the possession of the required qualification by the subject of the card will be held in place, while the slotted cards will drop down and can quickly be removed from the file.



This modern submarine has a disappearing gun which folds away below deck



Detail showing how neatly and compactly the gun and its support are packed under deck

A Gun Which Will Lie Down

THE submarine has been a defensive weapon in most navies. Apparently the Germans were the first to realize that it had offensive possibilities. We found a patent the other day applied for in the United States, by Julius Becker, an employee of the Krupps. It proves our point.

It is interesting to note that the patent was applied for in 1909, showing that even then Germany was awake to the uses of the submarine as an offensive weapon.

A hollowed-out compartment on the deck of the boat receives the gun. The gun barrel is mounted on a pivot fork, turned toward the muzzle, so that when not in use, the gun can be folded down horizontally. The pivot support also folds down, coming either over or under the barrel of the gun. Four removable rods, which are joined to the platform, support the gun column when in use.

A pipe extends from the compartment to the water. This takes care of any overflow which may enter when the gun is in action.

When folded away the gun takes but little of the limited space on a submarine, and thus low-lying and protected by a water-proof cover, it offers no resistance to the submerged travel of the boat. In other words, Becker boldly attacked the problem of arming a submarine with a weapon which could be raised or lowered at will, as the vessel came to the surface or submerged.

Magnetized Birds? Another Explanation of Accurate Migratory Flight

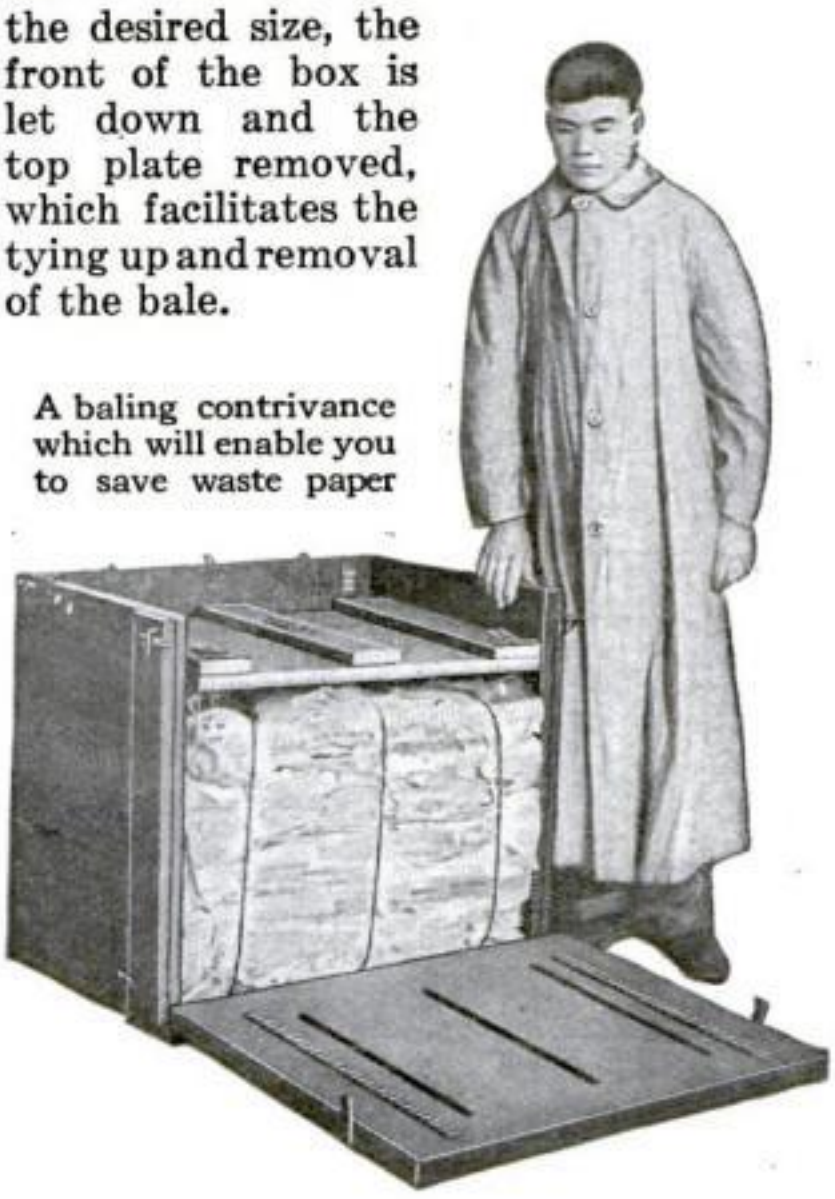
ONE of the many explanations that have been offered to account for the fact that migrating birds are able to find their way by night and in cloudy or foggy weather is that they are sensitive, in some way, to currents of terrestrial magnetism, and therefore direct their flight by the magnetic meridians. This suggestion was put forth by M. A. Thauziès, a French pigeon-fancier, who declares that carrier-pigeons make poor flights during the occurrence of magnetic storms. He also asserts that the general use of wireless telegraphy has diminished the reliability of these birds to a surprising extent.

Those of us interested in science, engineering, invention form a kind of guild. We should help one another. The editor of the POPULAR SCIENCE MONTHLY is willing to answer questions.

Don't Throw Away Waste Paper. Bale It!

EVERY household, every school, store or public building is everlastingly confronted with the problem of how best to dispose of the accumulations of waste paper, newspapers, paper bags and wrapping paper. To destroy paper stock is a great waste of money as the price of paper is extremely high.

William J. Palm, of Minneapolis, has invented and placed upon the market a simple contrivance which offers an inexpensive and adequate solution of the waste paper problem. The invention consists of a stout box, open at the top and with a hinged front. The back and the movable front of the box have each, on the inside, two ratchet bands into which engage the pawls of the sliding press-plate. The paper is deposited in the box which rests on strong swivel-rollers and is pressed down by the top plate. When the compact bale of paper thus formed has reached the desired size, the front of the box is let down and the top plate removed, which facilitates the tying up and removal of the bale.



A baling contrivance which will enable you to save waste paper

© Int. Film Serv.

The thermometer registers ten below zero. But they take their dip just the same—Br-r-r!

The Human Polar Bears. They Bathe in Icy Water—Br-r-r.

DURING the bathing season many thousands enjoy the cooling surf at Coney Island every day, but when the winter brings zero temperature and icy blasts from the north, and big ice stalactites form on the piers and on the lower side of the board-walk, Coney is almost deserted. Only a small group of hardy men, who fittingly call themselves Polar Bears, remain true to Father Atlantic and daily disport themselves, clad in their bathing suits, upon the icy beach and amid the floating ice in the ocean.

The accompanying picture was taken at Coney Island on one of the coldest days of the winter. The thermometer registered ten below zero and the photographer was nearly frozen while taking the picture. Well, after all it is but a matter of constitution, inclination and habit. The Polar Bears really seem to enjoy their icy winter bathing.

Learning to Duel in the Sky

How the towed target balloon is used in machine-gun practice

By Lieutenant Henry A. Bruno

Late Imperial Royal Flying Corps, Canada

A FEW weeks after America entered the war plans were made for the immediate training of thousands of air-fighters. Some of the best army men in the United States service were sent to Canada to find out something about the science of training men for aerial warfare.

The largest aerial gunnery school in Canada is the one at the Royal Flying Corps Headquarters, Camp Borden, Ontario. To-day there are several gunnery schools in this country modeled after Camp Borden, and the methods used in the United States are slight improvements over those adopted by Canada.

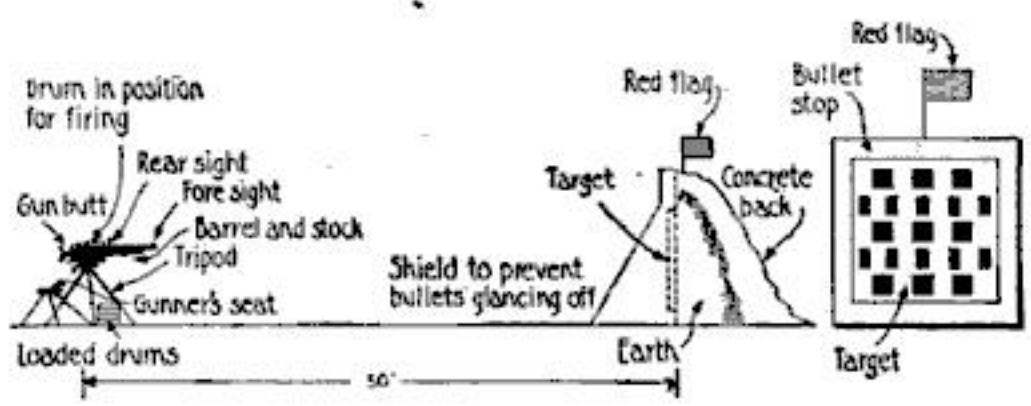
It is at the ground school that the prospective air-fighter first makes the acquaintance of a machine-gun. In order to graduate from the machine-gun division of the ground school he must be able to take down and assemble both the Lewis and Vickers guns.

Firing, with trench machine-guns, at large targets placed in gun-pits, is the first actual firing done by the pupils.

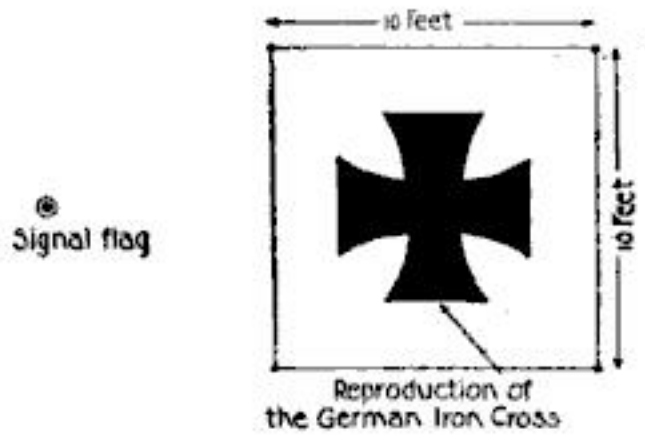
After receiving Q. V. G. ("Qualified Very Good") on this ground gun work, the pilot takes his first actual lesson in aerial gunnery. A standard Curtis, two seater, ninety horsepower training biplane is used, altered so as to allow a gun to be fitted. The target, a square of white canvas bearing a reproduction of the German iron cross in the center, is laid out on the ground. Two signal flags are raised to warn the curious away.

You climb into the plane, and strap yourself tightly in your seat. As the gun (an eighteen-pound Lewis) will move up and down only about ten inches, the only way to get a shot at the target is to have the pilot shut off his motor and dive nose first to within a few feet of it. Then you grind out your shots and swoop up again. If your pilot doesn't open up his motor and swoop up in time, you crash. If you fire at too long a range the instructor will call your attention in no gentle way. If your pilot shows fear in not getting close enough to the target, both of you will get a worse reprimand than if you were to smash several machines.

About a week later you will be ready for advanced air practice. This time the target is a pear-shaped



The target, fifty feet from the gun, consists of white canvas with black squares painted on it



Appearance of the target, at which the flyer directs his fire, as his aeroplane dives down

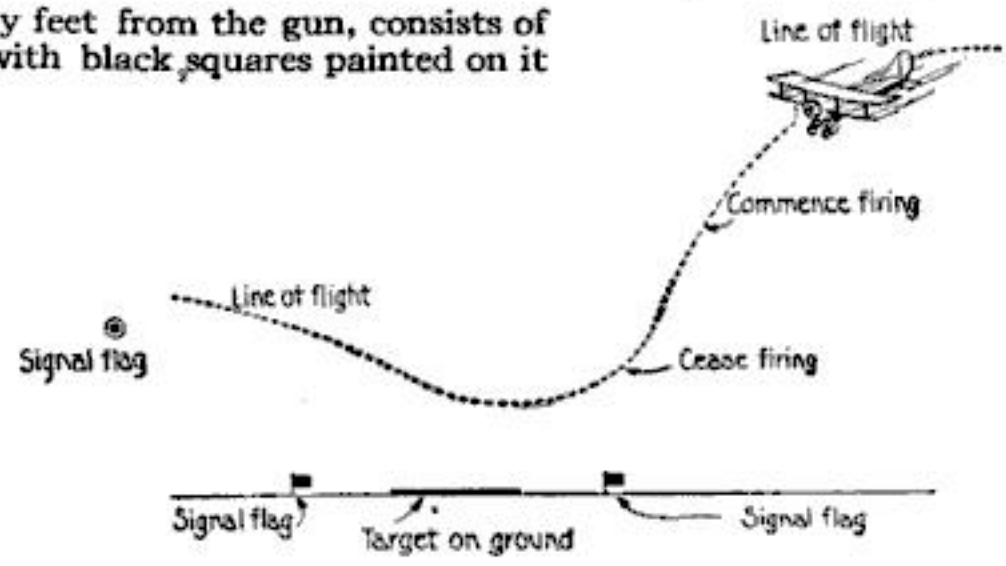
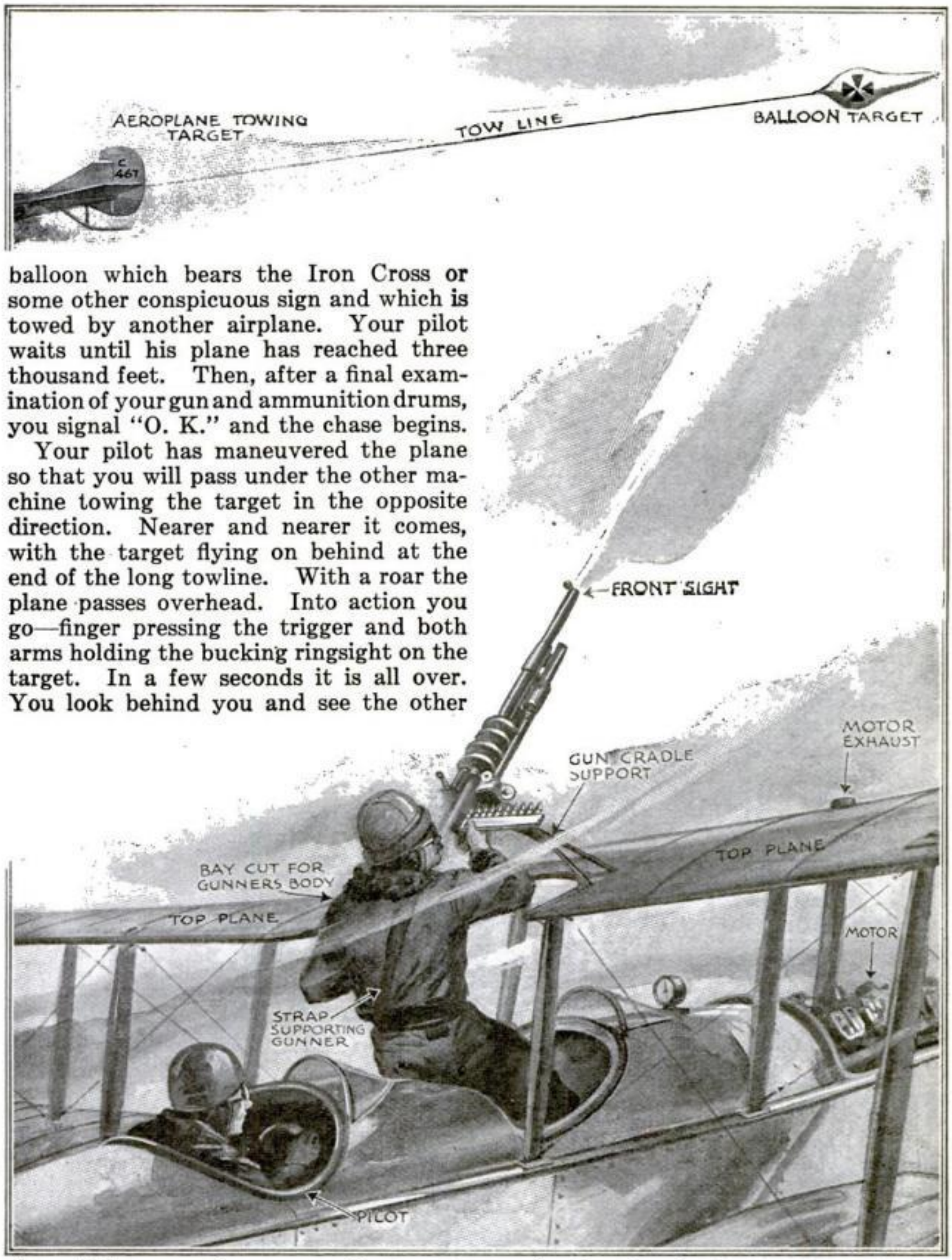


Diagram showing the line of flight in practice and marking the proper position for firing

How Dueling in the Air Is Taught



balloon which bears the Iron Cross or some other conspicuous sign and which is towed by another airplane. Your pilot waits until his plane has reached three thousand feet. Then, after a final examination of your gun and ammunition drums, you signal "O. K." and the chase begins.

Your pilot has maneuvered the plane so that you will pass under the other machine towing the target in the opposite direction. Nearer and nearer it comes, with the target flying on behind at the end of the long towline. With a roar the plane passes overhead. Into action you go—finger pressing the trigger and both arms holding the bucking ringsight on the target. In a few seconds it is all over. You look behind you and see the other plane flying serenely away. The target is undamaged. You have wasted a drumful of cartridges on the empty air. "Rotten," you say to yourself. Obedient to the control of your pilot the plane goes over in a loop. You come out of it pointed in the right direction and are off again after the elusive target. This time you are more careful. Your shots go home. With the shattered target flying in the wind, the hunted plane spirals to earth. A few minutes later you are on terra-firma again, receiving a report from your instructor on your exploits.

Baring the Super-Zeppelin's Secrets

What the French found when they examined the L-49 which fell into their hands after an air raid on England

By Carl Dienstbach

Kadel & Herbert

One of the control cars attached to a super-Zeppelin. Its functions are evident

IT was the oddest sort of an accident that preserved the L-49 intact for French inspection. She was one of a fleet of super-Zeppelins which had successfully eluded the airplanes and anti-aircraft guns of Great Britain, only to come to grief on French soil. She lost her way. Her gasoline supply exhausted, she was compelled to descend in the heart of France. True to his duty, her captain attempted to destroy her. He leveled the pistol which was to fire into her great hydrogen-filled envelope a flaming pellet, when he heard a shout:

"Hands up!"

He looked around and found himself gazing into the muzzle of a shotgun in the hands of Jules Boiteux, who had been out hunting. The crew had retired to a safe distance because of the conflagration that would follow the ignition of the gas. There was nothing left for it but to yield. And so a man with a shotgun captured one of Germany's latest super-Zeppelins and placed in the hands of the French Government military information almost priceless.

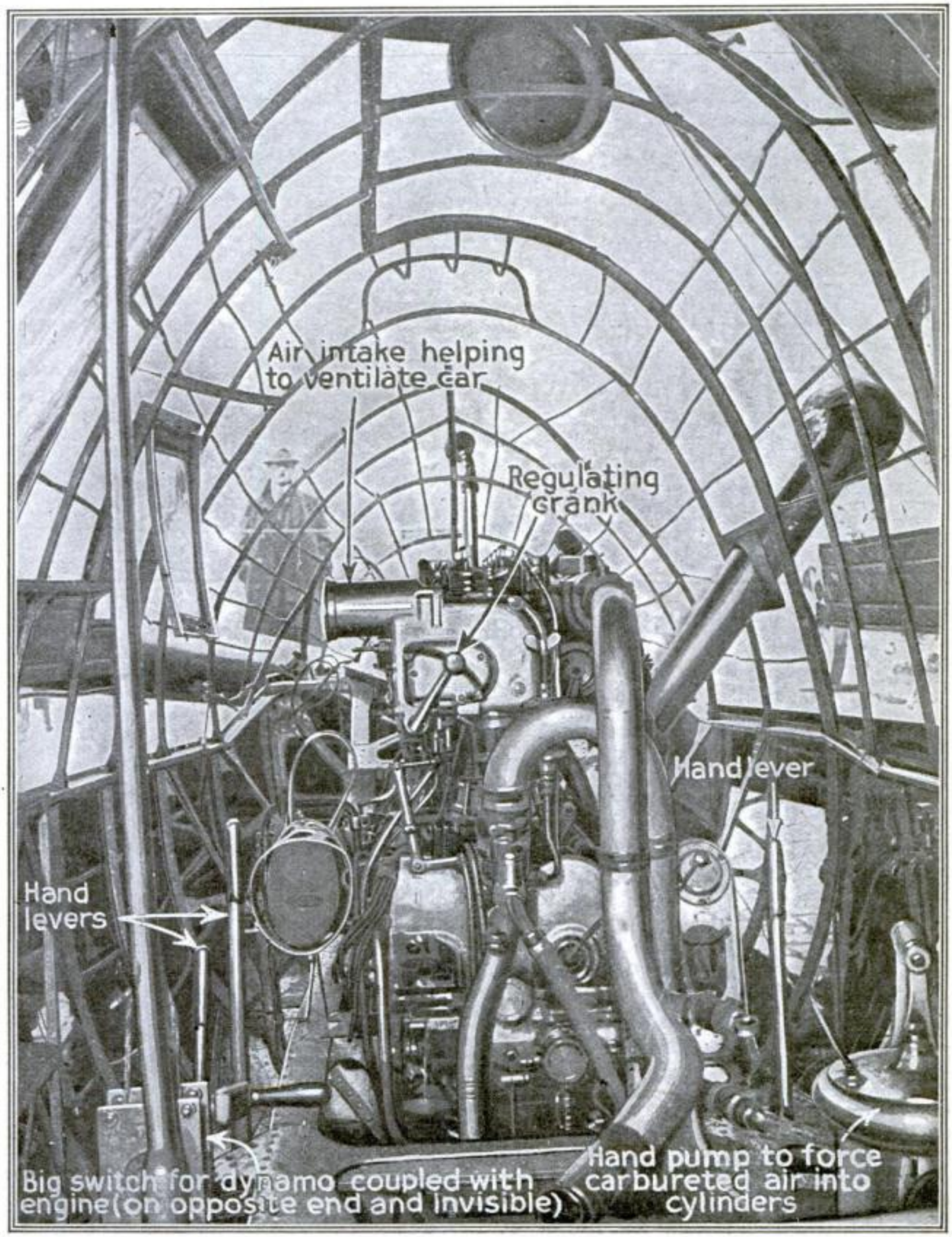
How Fuel Was Sacrificed to Carry Bombs

Why was the L-49 forced to land? A super-Zeppelin has a radius of action and a bomb carrying capacity far exceeding that of any other type of aircraft. The experiences of the war have demonstrated that the dropping of a mere bomb or two is a futile proceeding. Literally tons of explosives must rain down from the sky to justify the risks of a bombing expedition. When airplanes set out to raid German towns they travel in scores—a fashion inaugurated by the French. Only thus is it possible to deliver a telling blow. Because of its enormous carrying capacity, a super-Zeppelin is in many respects a better bombing apparatus than a flock of airplanes. But the L-49 could not carry tons of explosives from Oldenburg to London without sacrificing some of her fuel-carrying capacity. Her fuel load had to be reduced to an unsafe minimum.

He did it with his little shotgun

This juggling of loads also has its effect on the maneuvering power of a Zeppelin. It has been pointed out more than once in the pages of the POPULAR SCIENCE MONTHLY that a huge dirigible flies not only as an airship but also as an airplane. In other words, it is buoyed up not only by its gas, but also by the upward pressure of the air against its enormous surface. Indeed, were it not for the pressure of the air against its thousands of square feet of exposed area—a pressure comparable in every respect with that which keeps an airplane aloft—the giant rigid dirigible would be an impos-

Zeppelins Are All Ribs and Machinery

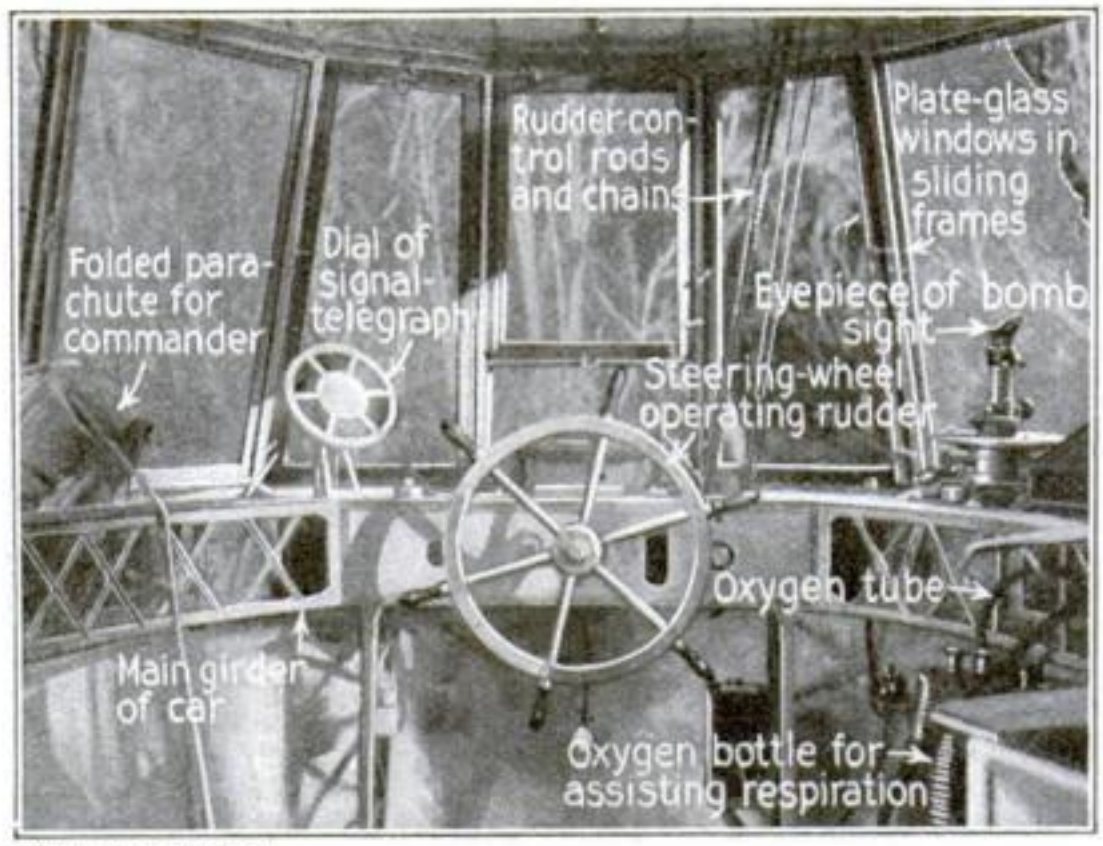


French Official Photo

Interior of a Zeppelin Engine Car

Now that the secrets of a Zeppelin's structure are completely bared to the Allies, the question arises whether it is not as difficult to succeed in running one of the machines as to build it. German officers say they would not mind giving the Allies a Zeppelin. They think only Germans could run it. The difficulties of getting the ships in and out of hangars, are very considerable

sibility. It is this air pressure which is relied upon to control the craft when the gas expands at great height and is dissipated, or when it shrinks in volume in a cold layer of the atmosphere, or when tons of weight are added by dew, rain, snow or sleet. Moreover, descending or ascending currents of air force the ship up or down, and these currents must be counteracted by flying the ship airplane-style.



© Kadel & Herbert

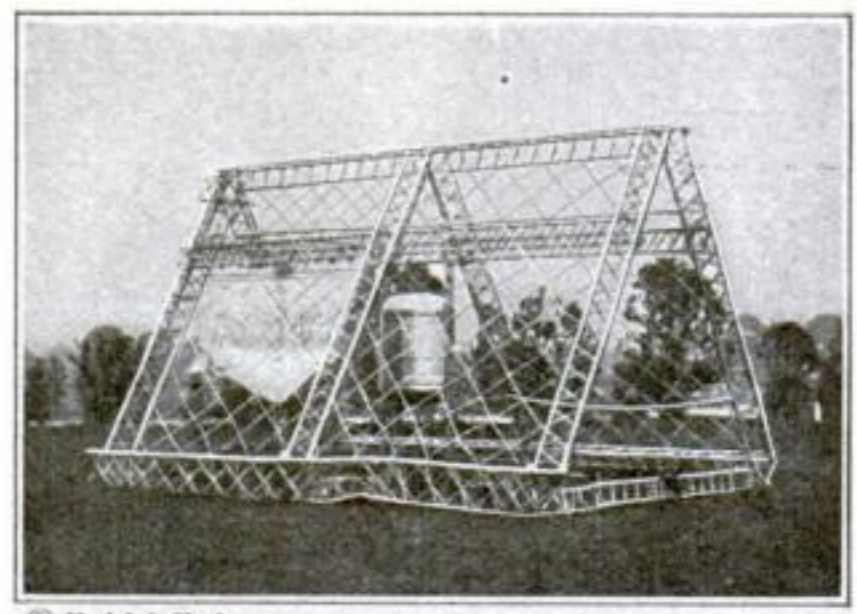
Interior of the commander's cabin, L-49. This was the directing head, and navigating center of the big craft

All this means that much is expected of the engines. The ship must be driven through the air at high speed if the most is to be made of the airplane effect. Since so much depends on mere motive power, the L-49 had been reduced to a huge cylinder of gas, a few cars for the crew, an enormous load of bombs, and the most powerful engines that air can support.

Wireless Signals from Germany Guide the Zeppelins

The passenger-carrying Zeppelins that plied over the Rhine before the war, had luxurious cabins. Fully three times as bulky as these ante-bellum vessels, the L-49 was nevertheless as bare of comforts as a racing automobile. She had been stripped of everything not absolutely necessary. For instance, she had only two machine guns; hence she was practically defenseless.

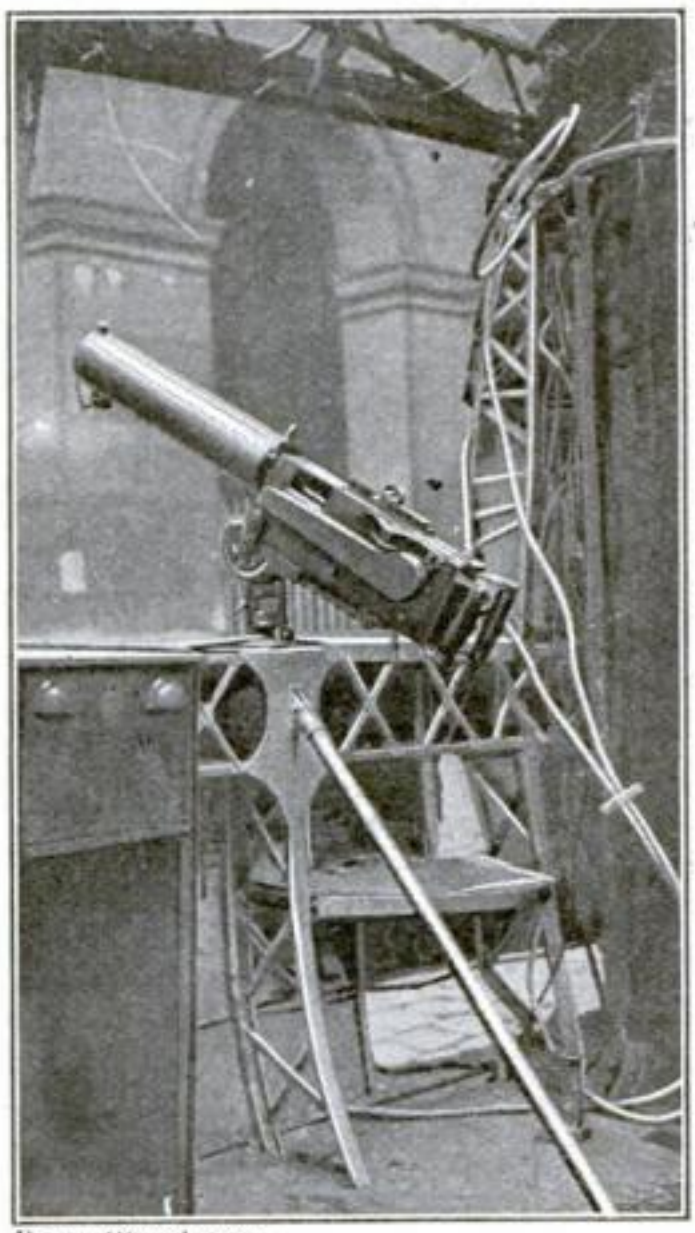
To the necessity of greatly reducing the amount of fuel so that an enormous quantity of bombs might be dropped on England, may be attributed the capture of the L-49 on French soil. Just how she lost her way, it is needless to explain here; the subject is discussed in the April issue of the POPULAR SCIENCE MONTHLY. It may be stated in passing, however, that Zeppelins are guided by wireless signals sent from German stations. The capture of the L-49 may be attributed either to those unexplained vagaries of wireless with which every amateur operator is familiar, or to ingenious radio deception on the part of the English or French. Of a fog-bound raiding squadron of a dozen or more ships, two returned safely on their regular course; six lost their way, drifted temporarily over France, luckily for them unobserved, and succeeded in stemming a frigid, violent northeasterly gale that had sprung up enough to regain German territory. The rest succumbed to attack and came to the end of their supplies in a gale which they had had to buffet with a limited amount of fuel. Rising to an altitude of 16,000 feet to escape shells and pursuing airplanes, they encountered an upper wind so violent that they drifted



© Kadel & Herbert

This is the triangular keel (part of it at least) from the ridge of which fuel tanks are hung like clothes from a wardrobe pole

farther and farther into France in spite of all their fuel-wasting efforts. One vessel had been ignited in the air by an anti-aircraft battery into the range of which it had blundered. One senselessly kept on fleeing until it was literally swallowed up by the Mediterranean. Two wisely landed and surrendered. One of them was the L-49 which was so oddly prevented from hiding its secret by self-destruction; the other was reduced to a mere mass of wreckage by its commander. A fifth, of uncertain identity, is supposed to have gained Switzerland (possibly Friedrichshafen) in a damaged condition.



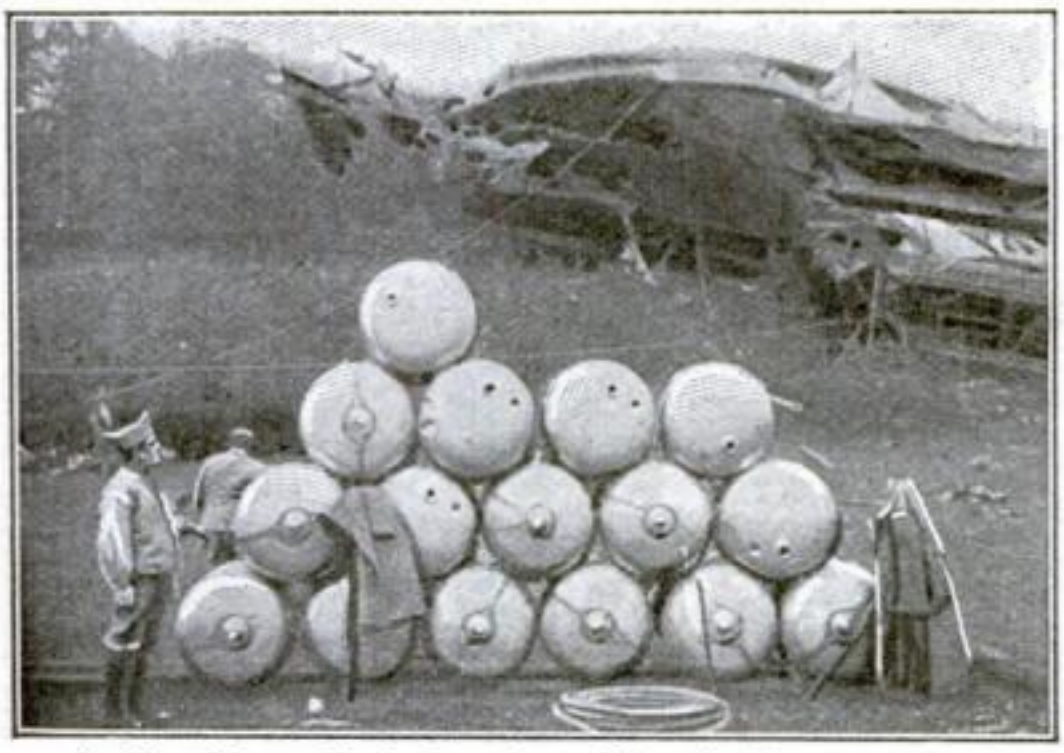
French Official Photo

Machine-gun of the commander's cabin of the super-Zeppelin L-49

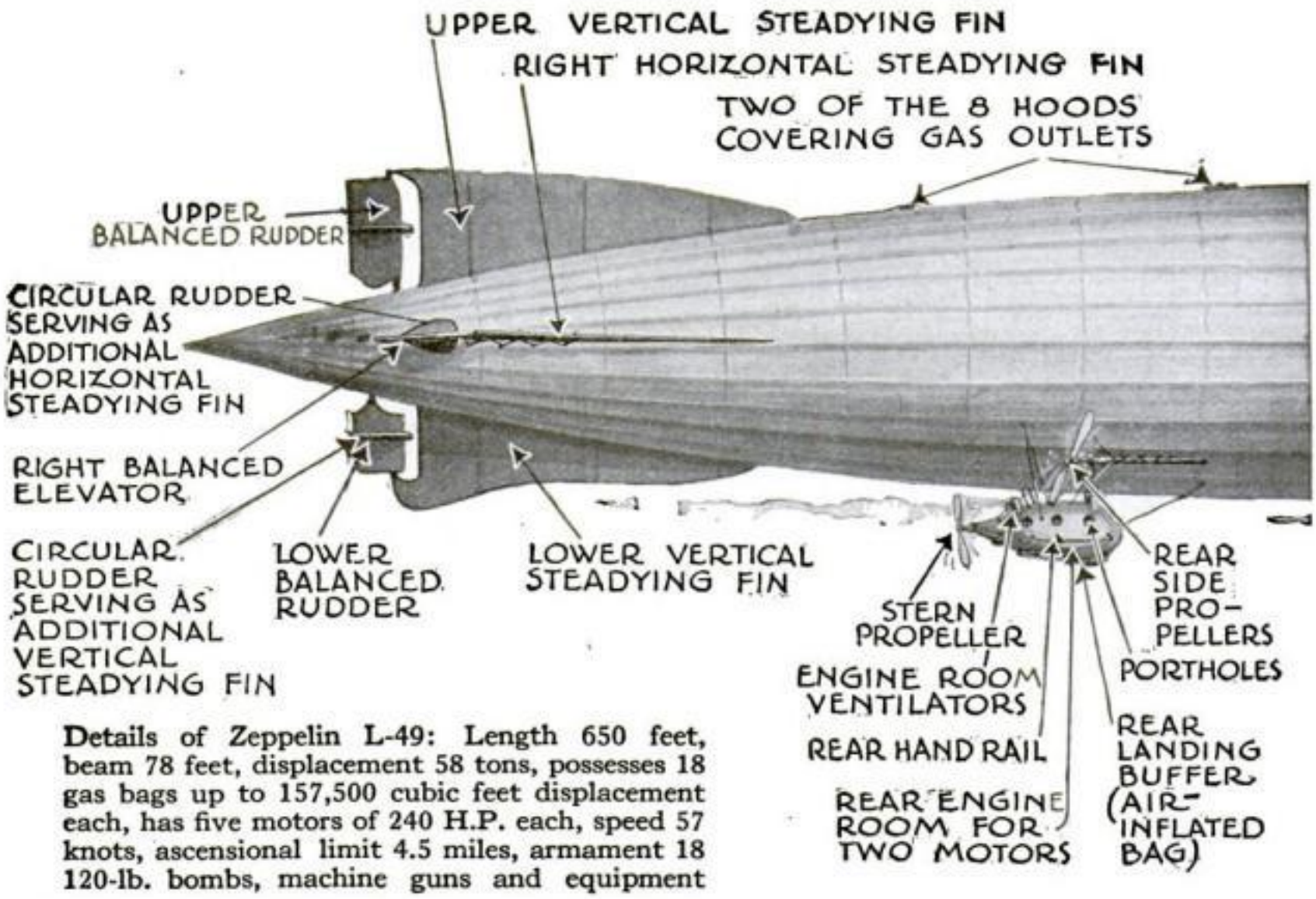
An Immense, Naked Hull of Perfect Form

The marvelous progress in design revealed by the L-49 is apparent to anyone who is at all familiar with the evolution of the Zeppelin. Her perfection lay in her simplicity. Speed is the life and soul of a Zeppelin—a speed that is never less than sixty miles an hour and may be as much as one hundred. Speed saves the Zeppelin from destruction in a gale. And speed has been obtained by trebling the size and by applying the lessons learned in developing the one-hundred-and-thirty-mile-an-hour fighting airplane.

In an airplane, it will be remembered, wires and struts are eliminated wherever possible; they offer too much resistance to the wind. The aviator is seated in a beautifully modeled boat-like body which parts the air with little disturbance, thanks to its streamline form. The rudders are as simple as possible. All the lessons which the war has taught the airplane designer have borne fruit in the L-49. There is the same inclosing of mechanical and structural parts, the same streamlining everywhere, the same simplification of rudders, the same reduction of surface and friction, the same disregard of mere bulk, provided it is correctly designed. As the drawing shows, the L-49 is but a naked, immense fish-shaped envelope of perfect stream-line form, with single monoplane fins and rudders, and with absolutely no appendages save four cars, each entirely enclosed and each torpedo-shaped. Only a rigid hull permits such ultra-refinement of form. Here we have another parallel with the development of the airplane. As the number and rigidity of the ribs in an airplane was increased, so all types of dirigibles have ceded their place to the Zeppelin despite opposition—all for perfectly good and practical reasons. The smooth, clean sweep of the craft was broken on the



A pile of Zeppelin fuel tanks. The airships must carry much fuel because of long trips and exigencies met with

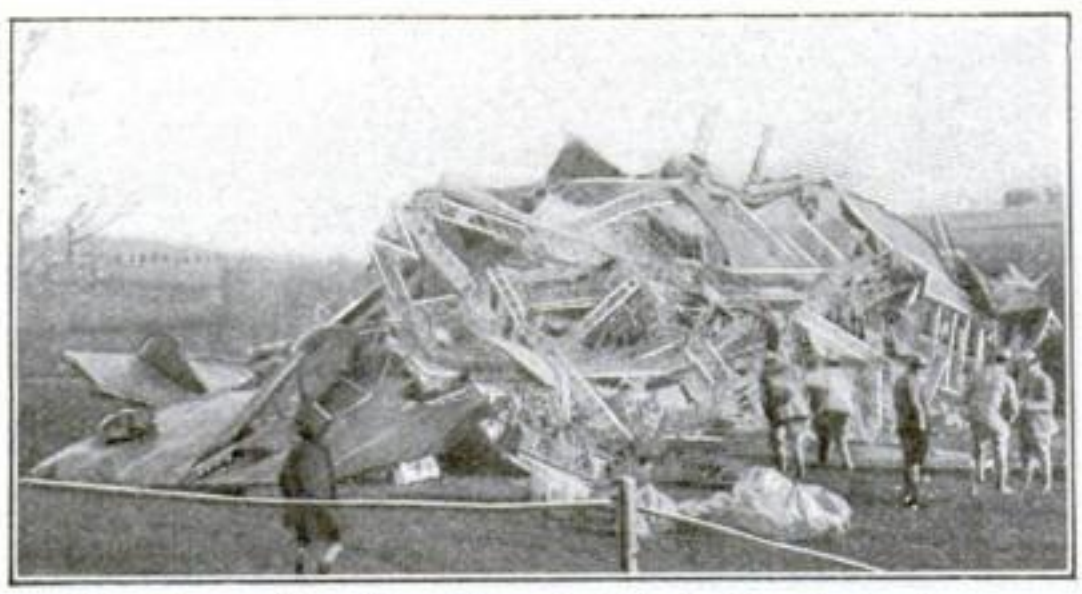


Details of Zeppelin L-49: Length 650 feet, beam 78 feet, displacement 58 tons, possesses 18 gas bags up to 157,500 cubic feet displacement each, has five motors of 240 H.P. each, speed 57 knots, ascensional limit 4.5 miles, armament 18 120-lb. bombs, machine guns and equipment

sides and at the rear car only by the mountings and shafts of two propellers—a strictly necessary evil because two of the propellers must run when the cars rest on the ground and because the others behind the cars cannot revolve.

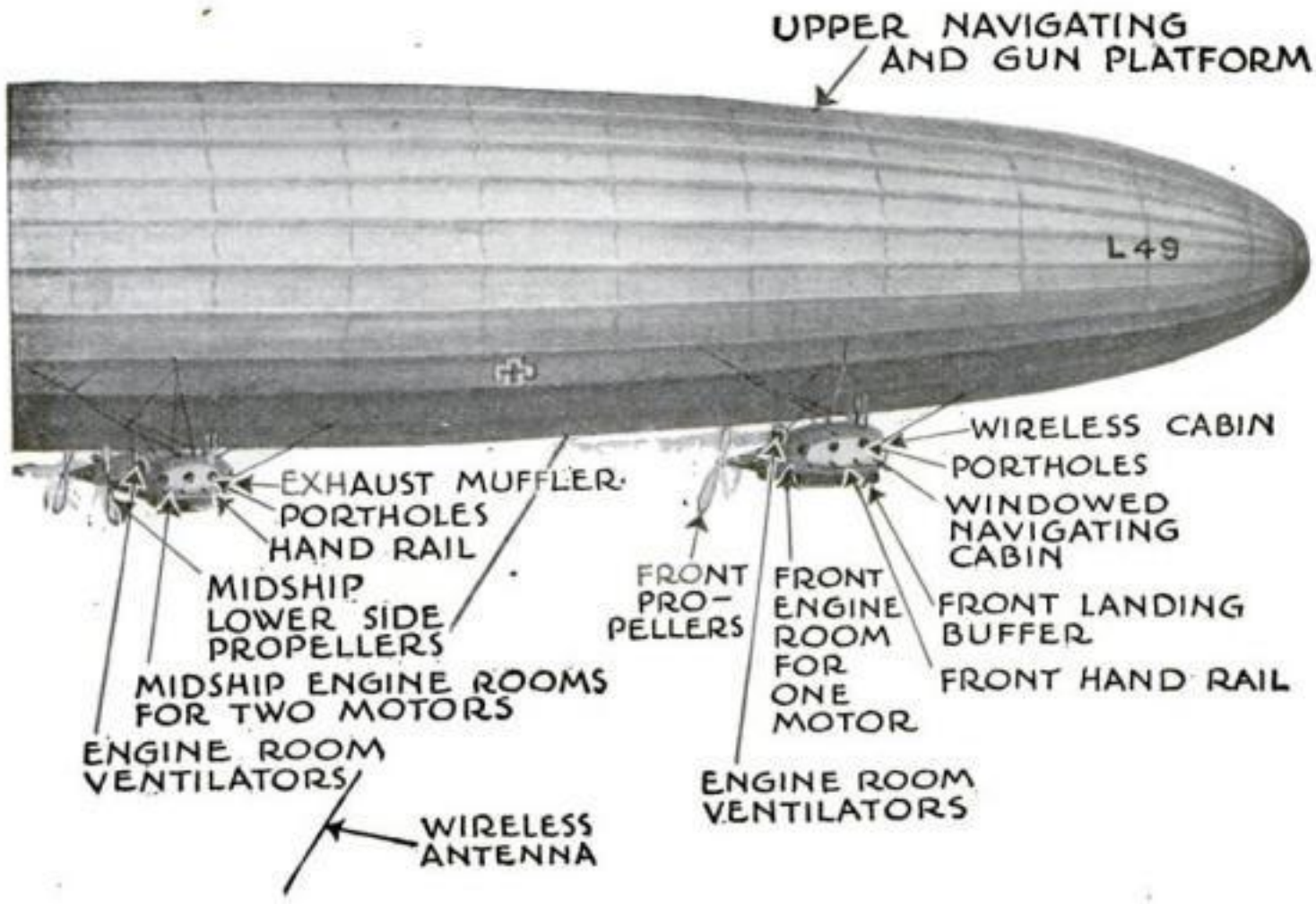
In the old Zeppelins there was a triangular keel under the hull. The L-49 has that keel too; but it has been inverted like a glove so that now it protrudes into the interior with the apex of the triangle uppermost. It stiffens the envelope—its function from the very beginning; but two-thirds of its air friction is eliminated by this ingenious tucking away of its larger sides. Why were not the cars and engines moved into the envelope as well? There was no necessity for that. Modern science teaches that a streamlined bulk affords no more wind resistance than slender irregular appendages. The cars were given the shapes of torpedoes. Hence they offered no serious impediment to speed and dispensed with the weight of special apparatus for insulation and ventilation that would be needed for engine rooms inside the gas-inflated hull.

Small as the cars are, the space allotted for the crew is not "as restricted as in a submarine," as the French put it. There is an abundance of room in a wide passageway within the immense hull. But there is not as much comfort as may be supposed. These ample cabins serve merely as a shelter from the icy gale that beats against the outside of the ship. They are about as comfortable as the clouds of heaven are for the angels pictured in children's books. Being pitched about at sea is nothing compared with a refractory Zeppelin airship.



Wreckage of a Zeppelin. A labyrinth of aluminum frames, engines, and elaborate control mechanism

A Zeppelin is at once the flimsiest and the staunchest of artificial structures. When the old Zeppelin was

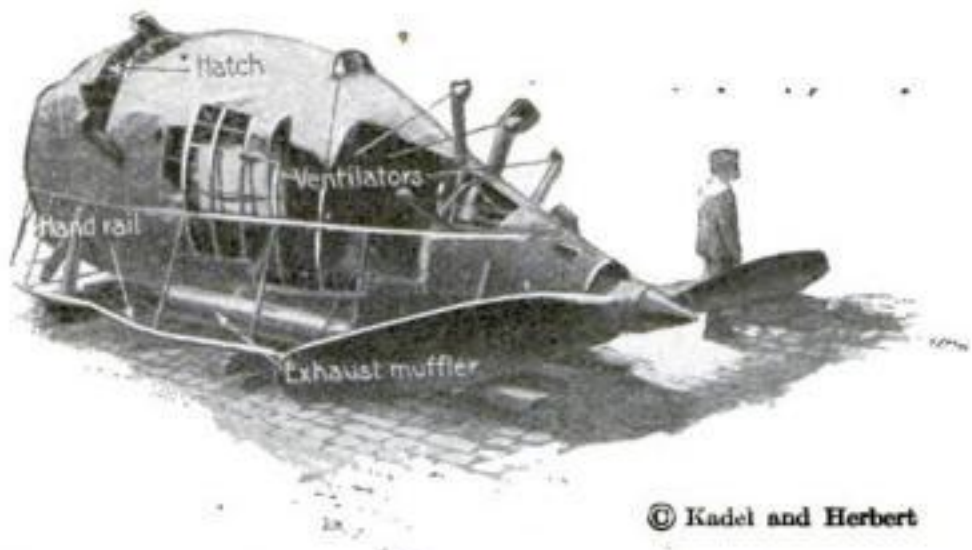


trebled in size the weight could not be disproportionately increased.

"A Gigantic Piece of Lacework," said the French

The framework of the huge hull in which the gas bags are confined has been multiplied in parts and reduced in material to a veritable cloud of riveted lattice-work made of channeled strips of the thinnest aluminum sheeting. Indeed, the frame of the L-49 has been described by the French as a "gigantic piece of lacework."

This frame serves exactly the same purpose as the pole in your wardrobe, from which you suspend coats on hangers. As a whole, the frame could resist the fiercest gale, and yet it could not support a single man's weight on one of its component parts! If ever there was a scientifically designed structure, it is this framework of the L-49. It is applied science with a vengeance! From a long row of correctly placed hooks, hang all the aluminum fuel tanks, the water ballast tanks and lastly, all the bombs—just as the clothes in your closet are suspended from the pole on their hangers. The fuel tanks are dropped through trap doors on guides like ballast. The bombs fall similarly; but they are electrically released, since the one-hundredth part of a second is vital in hitting a target and human agency is too slow.

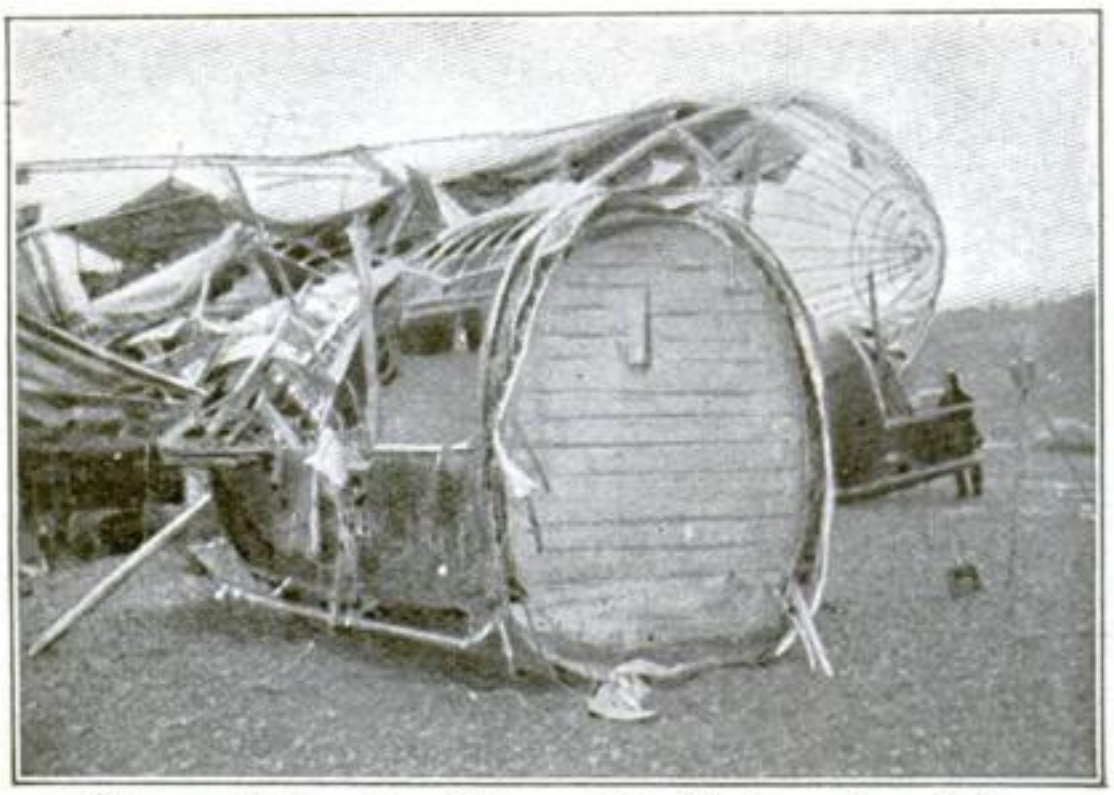


© Kadel and Herbert

Rear view of car containing the Zeppelin engines and related mechanism. Note streamline form of the body

The Gloomy Boardwalk

Within the framework is a long passageway for the crew—a mere boardwalk, nine inches wide, composed of wooden slats separated one from the other by several inches. Along this passageway hangs a series of hammocks or cots. The crew almost "sleeps on a clothes line." Real comfort was merely a subject for pleasant dreams, for life in that passageway must have resembled that of a tight-



The padded wall which sealed off the noise of the engine room from the wireless cabin—another refinement

rope walker who dines and sleeps in pretended comfort on his lofty perch. Airships can roll and pitch like any steamer on the bounding deep, and so a hand-railing in the shape of a wire cable is provided on one side of this board-walk. If a man stumbles he is caught by a wide netting of rope cord, "the thickness of a pencil" as the French said—a netting placed, not to save his neck, but to stiffen the cloth covering of the hull against the gale. It is doubtful if that thin netting would save him from the abyss below. I traveled in the passenger Zeppelin "Viktoria Luise" before the war. I understand now why I was warned that "passengers are not permitted outside the cabin," by an officer who saw me peeping through the door that led into the passageway. At night a man is guided along this perilous board-walk not by electric lights (they would betray the presence of the ship to an anti-aircraft battery below), but by ghostly patches of luminous paint. Even in daytime the place must be weird and gloomy, because the ship's whole belly is painted coal black to make it invisible at night. The upper surface of the hull is painted white and gray to blend with the clouds as seen from an airplane.

Other details of the L-49, the dimensions, the power, the number of engines and propellers and their arrangement only corroborate what has been quite correctly described in previous articles on Zeppelins, published in the POPULAR SCIENCE MONTHLY. The only important progress made consists in torpedo-shaping and stream-lining all the cars.

Although life on a super-Zeppelin is not exactly luxurious, some comforts at least are provided. The protection against the biting wind is perfect. The powerful dynamos which supply the radio apparatus also furnish current for electric heating.

The material of the gas bags is cotton-lined goldbeaters' skin. To me the chief advantage of such a fabric lies in the fact that it remains gas-tight in the flabby, even crumpled condition that the gas bags so often must assume when they return to a low altitude after they have been inordinately expanded by a flight at 10,000 feet and more.

This, then, is briefly the kind of machine a Zeppelin is. Germany's well-guarded secret is in the hands of the Allies at last, and they will no doubt make good use of it. They already have a good number of air-craft of their own, but pointers are always welcome, even from the enemy. If there is anything new or advantageous about this enemy machine the Allied engineers may be depended upon to utilize it to its full value, for Germany has not a monopoly of all the brains and ingenuity.

The super-Zeppelin's wireless; the very brains of the aerial monster. Note its size

Identification Tag of Indestructible Metal for Naval Men

THE difficulty of finding a simple and adequate method of identifying soldiers or sailors who are killed or seriously injured in the course of war operations, has been solved by J. H. Taylor, of Alexandria, Va., by the invention of an identification tag which was adopted by the U. S. Navy Department on May 12, 1917. The tag, which is considered the best in use in any country in the world, consists of a plate of Monel metal, which does not melt below a temperature of 3840 degrees Fahrenheit and is not corroded by salt water. The name of the bearer and other data are written with diluted printer's ink on one side of the tag, while a rolled impression of the bearer's right index finger is placed on the opposite side. The tag is then dipped in asphaltum and the superfluous asphaltum removed with a fine brush, after which it is heated until the ink on both sides is glossy. After cooling the tag is deposited in a nitric-hydrochloric acid bath which etches the surface of the metal not covered by ink. By means of a string or chain passed through a hole in it the completed disk is carried around the neck of the wearer upon all occasions, in the same manner as a charm, for it takes up no room and is put on and forgotten.

This naval identification tag only melts in the most intense heat and is not corroded by salt water, being of Monel metal

The War Is Causing a Decrease in the Number of Lunatics

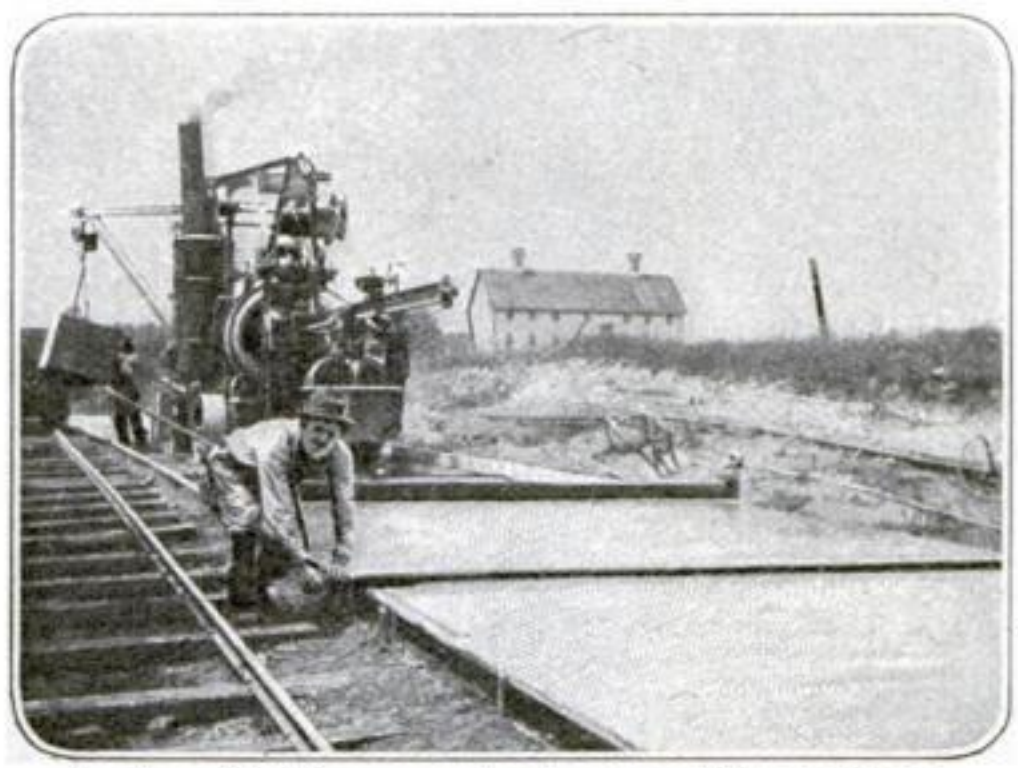
EVIDENTLY a great national struggle makes for mental steadiness. For the past two years there has been a decrease of over three thousand in the number of insane persons cared for in England and Wales. This fact is thought-provoking because before the war the yearly statistics showed a constantly increasing number of lunatics.

Rolling Roads with Gaspipe

A SIMPLE method for compacting the surface of concrete roads and removing excess water has been evolved by an engineer, B. F. Batchelder, of Ravenna, Ohio.

After striking off the surface with a template, according to Mr. Batchelder's plan, a piece of ordinary gaspipe, operated by two men, is used as a roller. After the excess water has come to the surface, another trip up and back with the roller removes all the water and leaves the surface in good condition for further finishing if necessary. A wave of mortar is carried ahead of the roller the "first time over," which fills in porous places or depressions. The second rolling removes nothing but water that is virtually clear.

This method is especially useful when using crushed stone or slag.



A piece of ordinary gaspipe is successfully used as a roller to remove excess water from the road surfaces

Clopperty, Clopperty, Clopperty!—The Hobby Horses Are Galloping!

THE accompanying picture represents the "field" just before the start of a thrilling race between wooden mechanical horses invented by Axel Olfort, of Chicago, the man upon the white racer, bearing the number twelve. These remarkable toy horses are able to walk, caper, gallop and kick just like live horses and do not require any food, a fact which will be highly appreciated at the present time with its abnormally high prices, by all owners of real horses. The mechanism which enables the wooden steeds to perform their surprising movements is hidden in the bodies of the racers and acts upon the legs, which are hinged to the bodies as shown.

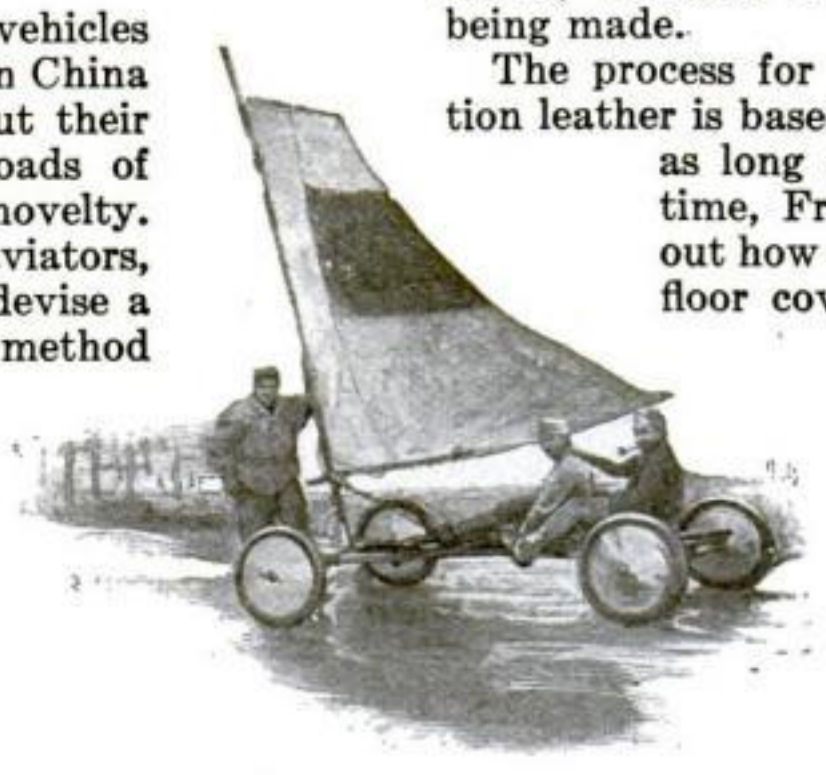
© Int. Film Serv

The mechanism which enables the steeds to perform is hidden, out of the way, in the bodies of the racers

Sailing Over the Tempestuous Macadam Road

SAIL-DRIVEN vehicles have been in use in China for many centuries, but their use upon the fine roads of France is rather a novelty. Some of the French aviators, in their eagerness to devise a moderately exciting method of spending their leisure time while on rest-leave behind the lines, built for themselves a sail-driven vehicle out of parts of German airplanes that had been brought down by them.

They utilized part of the framework for the body of the vehicle, put it upon pneumatic wheels taken from German machines, and to the slender mast upon the front truck they attached a sail patched together from canvas stripped from the wings of a captured German airplane. Other French aviators followed their example and soon exciting races in such peculiar vehicles became a recognized sport among the daring flyers enjoying a brief respite from their arduous and dangerous work at the front.



Land sail-boat made from captured German airplane materials and fittings

What Imitation Leather Is Made Of

LINSEED oil, certain paints, rosin, gum, and a chemical treatment — and we will have a compound as tough and as durable as leather! Such are the wonders of modern chemistry; from substances inelastic and useless of themselves, valuable commercial articles are being made.

The process for producing this imitation leather is based upon one discovered as long ago as 1864. At this time, Frederick Walton found out how a durable and sanitary floor covering could be made. This covering—the forerunner of our modern linoleum—consisted of strong canvas cloth covered with an oil-and-rosin compound heated and hardened while exposed to the air. A modification gives patent leather.

Making Two Wheels Take the Place of Three

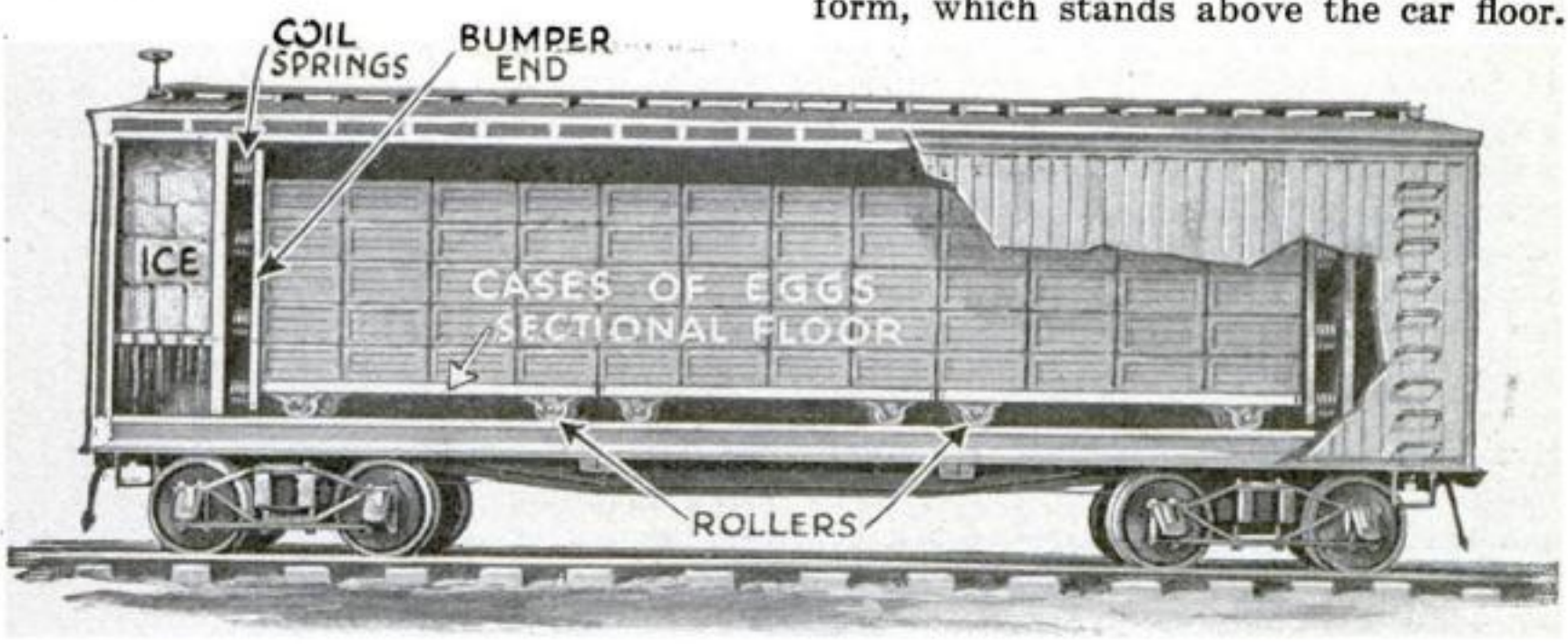
NECESSITY is the mother of invention. When the wheel of the sidecar attached to the motorcycle of Mr. John E. Hogg was crushed beyond repair by a skidding truck, while Mr. Hogg was riding with his wife near Pamona, Calif., on his way to Los Angeles, the cyclist did not abandon his trip, but completed his journey in the manner shown in the picture. First he removed the broken wheel and then he lashed a skid, improvised of a heavy board, under the chassis of the sidecar. A run of a few feet was sufficient to enable him to lift the car, with his wife sitting in it, off the ground and maintaining his balance by tilting his wheel and keeping it at the required angle. The run of twenty-five miles to Los Angeles was made without mishap, and at an average speed of thirty to thirty-five miles an hour. Much can be accomplished by a combination of necessity and ingenuity.

After a skidding truck had smashed the sidecar wheel, this cyclist tilted his outfit and rode twenty-five miles on two wheels

Shock-Absorbers for Eggs on Freight Cars Fill a Great Need

WITH eggs selling at from sixty to eighty cents a dozen and with the food shortage caused by the insufficient number of railway cars, the new design of shock-absorbing car device, shown in the accompanying illustration, should prove a boon, because it will reduce the breakage in transit and therefore reduce the cost of the eggs. A sectional platform on rollers is pushed into the ordinary refrigerator freight car so that it bears up against a series of coil springs at each end of the car next to the ice chamber.

The shocks that attend the coupling and uncoupling of cars are not transferred directly to the cases of eggs, but are taken up by the play of the platform against the coil springs at each end. The sectional floor is several inches above the main car floor. When the water from the ice boxes at the ends of the car overflows, the cases are not flooded, as the water runs off under the sectional platform, which stands above the car floor.



A sectional platform on rollers is pushed into the ordinary refrigerator freight car, so that it bears against coil springs. This absorbs the shocks and obviates much breakage during transit

Unclogging the Railroads to Get Coal

How New York's coal famine was relieved and how the Government is running the railroads

By Frank Parker Stockbridge

© Underwood and Underwood

Heavy, sea-going tugs break their way through ice jams in New York harbor, pulling immense coal barges. An example of conditions met this winter in coping with coal shortages

THE taking over by the United States Government of all the railroads of the nation, in December, 1917, and their operation as a single system, for the duration of the war, is the most sensational and interesting industrial episode of the war to date, so far as the United States is concerned. It will afford an opportunity to test many theories of railroad management and control that the roads under private operating conditions were not in a position to prove.

Almost the first action of Secretary of the Treasury William G. McAdoo, in his new official capacity as Director-General of Railroads, was to open up for freight traffic the heretofore unused short-cut between the New Jersey mainland and Manhattan Island, Long Island and the New England states, by directing that coal and other commodities should be hauled through the tunnels of the Pennsylvania Railroad's New York terminal system. These tunnels, which extend from the Jersey shore under the bed of the Hudson River, beneath Manhattan Island and under the East River to Long Island, were opened for traffic exactly seven years ago. The Pennsylvania spent nearly $100,000,000 on its terminal and tunnels, under a franchise that limited their use strictly to passenger traffic. Only the New York Central has ever had free access to New York city for its freight trains. All other freight destined for New York or for New England points can get as far as the New York Harbor terminals of the great trunk lines that converge at tidewater, but to get the cars to New York they had to be loaded on car floats and towed across the Hudson River, or the Bay, to railroad piers where they might be unloaded or whence they might be forwarded over the tracks of the Long Island or the New York, New Haven and Hartford.

Manhattan—A Cork in a Bottle

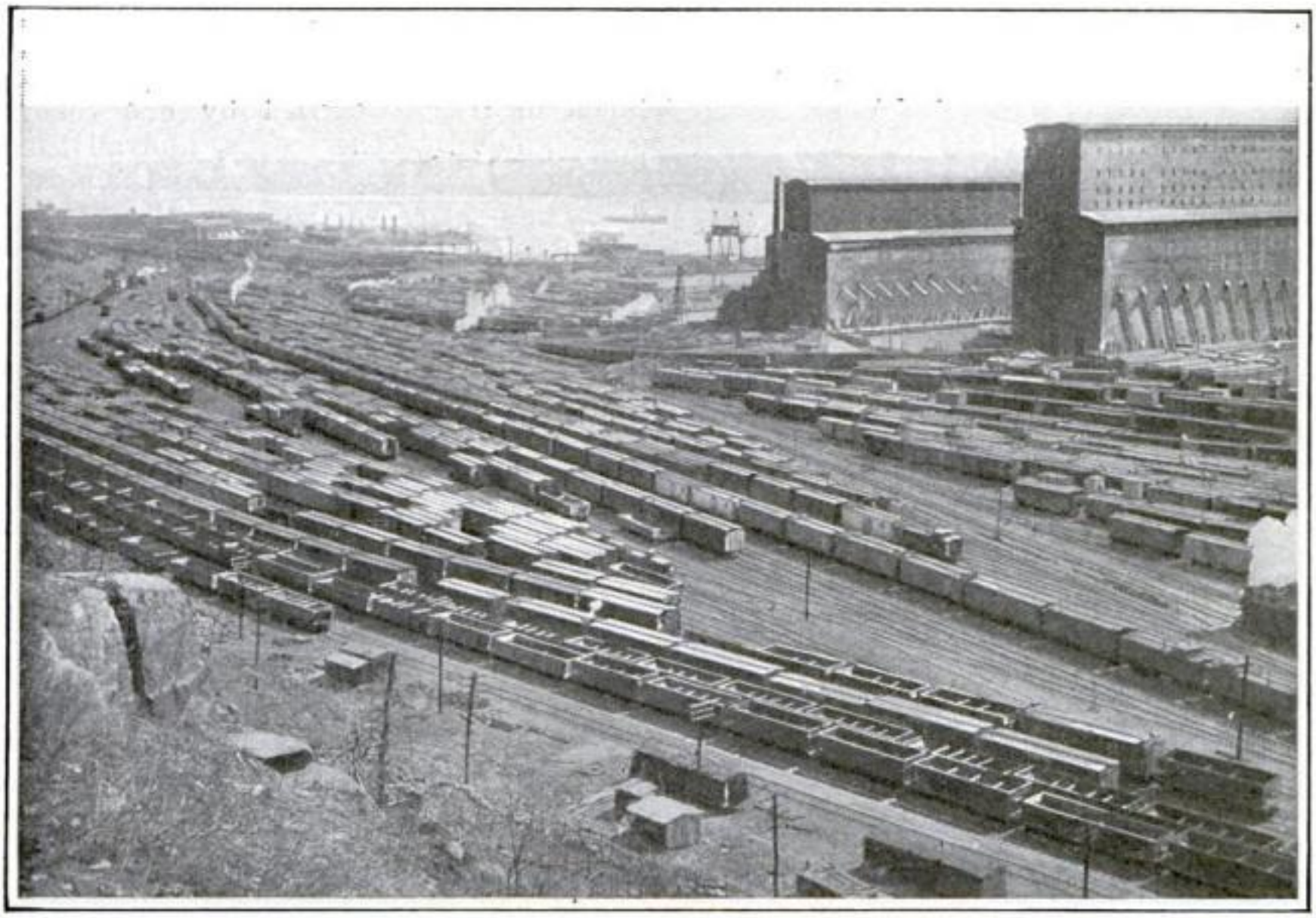
The new Hell Gate bridge, across the narrow neck of water where the East River joins Long Island Sound, owned jointly by the Pennsylvania and New Haven systems enables passenger trains to be run across to Long Island and so through the tunnels to the Pennsylvania terminal and on southward. Freight trains were sent over the new Connecting Railway to piers in Brooklyn, whence the water haul to the New Jersey piers was much shorter and safer than the old route. But the prohibition of freight

traffic through the tunnels still left Manhattan Island like a cork in a bottle, preventing the free flow of traffic by the shortest and easiest route.

Government control of railroads was the corkscrew used by Director-General McAdoo to pull the cork. It so happened that his taking over of the roads almost coincided with the worst coal shortage the East had ever known and the lowest temperatures in the history of the Weather Bureau. Freight could be moved in the Hudson and East Rivers only with the assistance of ice-breaking tugs. Hundreds of thousands of tons of coal were in cars at the various Jersey terminals; New York and New England were freezing. The cars could be sent through the tunnel. That is what the Government ordered done. From the Long Island yards coal was hauled across the Queensborough Bridge into Manhattan with less difficulty than it could have been handled from the piers formerly used, while trainload after trainload was sent on over the Hell Gate bridge to New England.

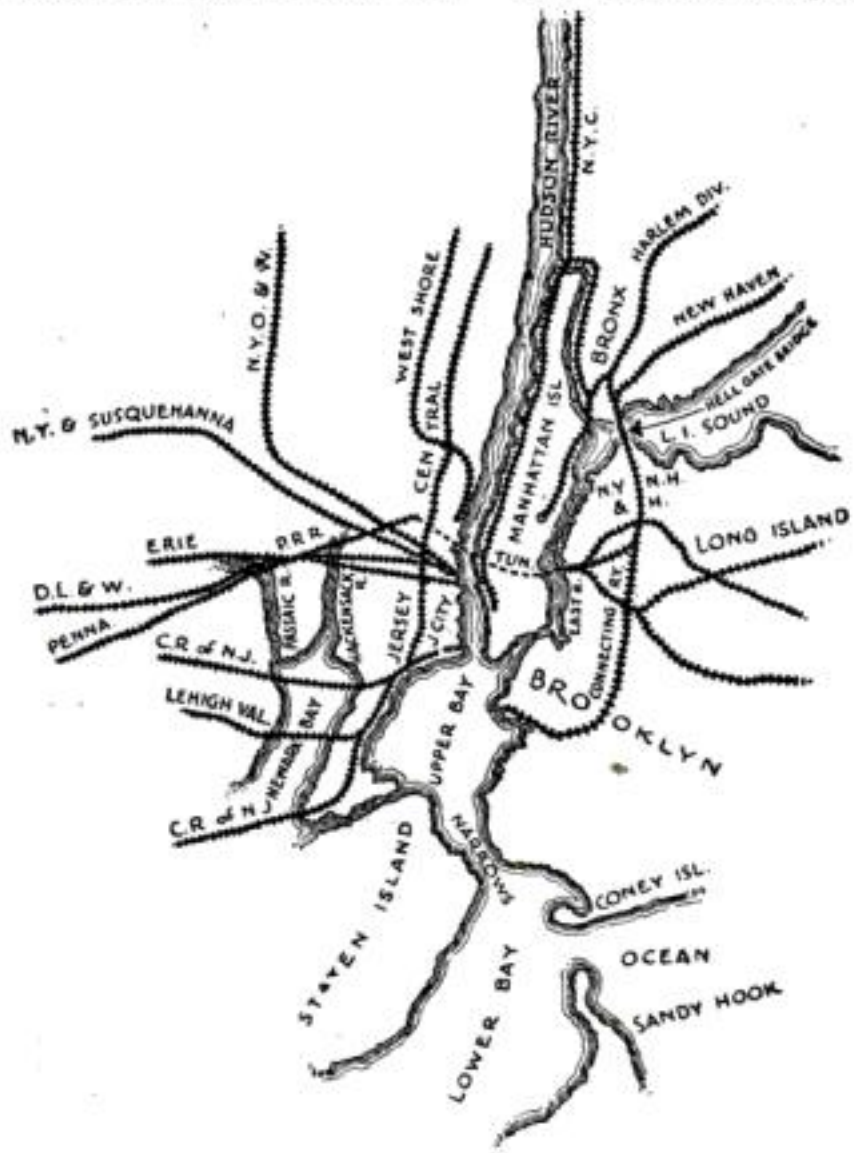
Cutting Down the Passenger Trains

Freight traffic counts for everything, passenger traffic for nothing, so long as it is necessary to rush coal and raw materials to the factories where munitions are being made, and shells, guns, explosives, aeroplanes, wheat and food supplies for our army in France and for our allies to seaboard shipping points and soldiers to and from training camps. The freight must be moved by the most direct and fastest routes. Under competitive conditions, the railroads could not meet the demands made upon them. One had not enough locomotives; another too few cars; a third could haul certain classes of freight only by roundabout routes; other roads were competing for the classes of freight that they could haul to best advantage. So the first result of Government control was to cut down the number of passenger trains. On the Pennsylvania system 104 weekday trains and 51 Sunday trains were cut off by a single order; the New Haven annuled 82 passenger trains; the Lehigh Valley's reductions in passenger service between New York and Buffalo save 75,000 train miles a month. Through trains that formerly carried sleepers throughout their run now hook on the sleepers at bedtime. Instead of



Clogged! A typical scene in a New York freight terminal

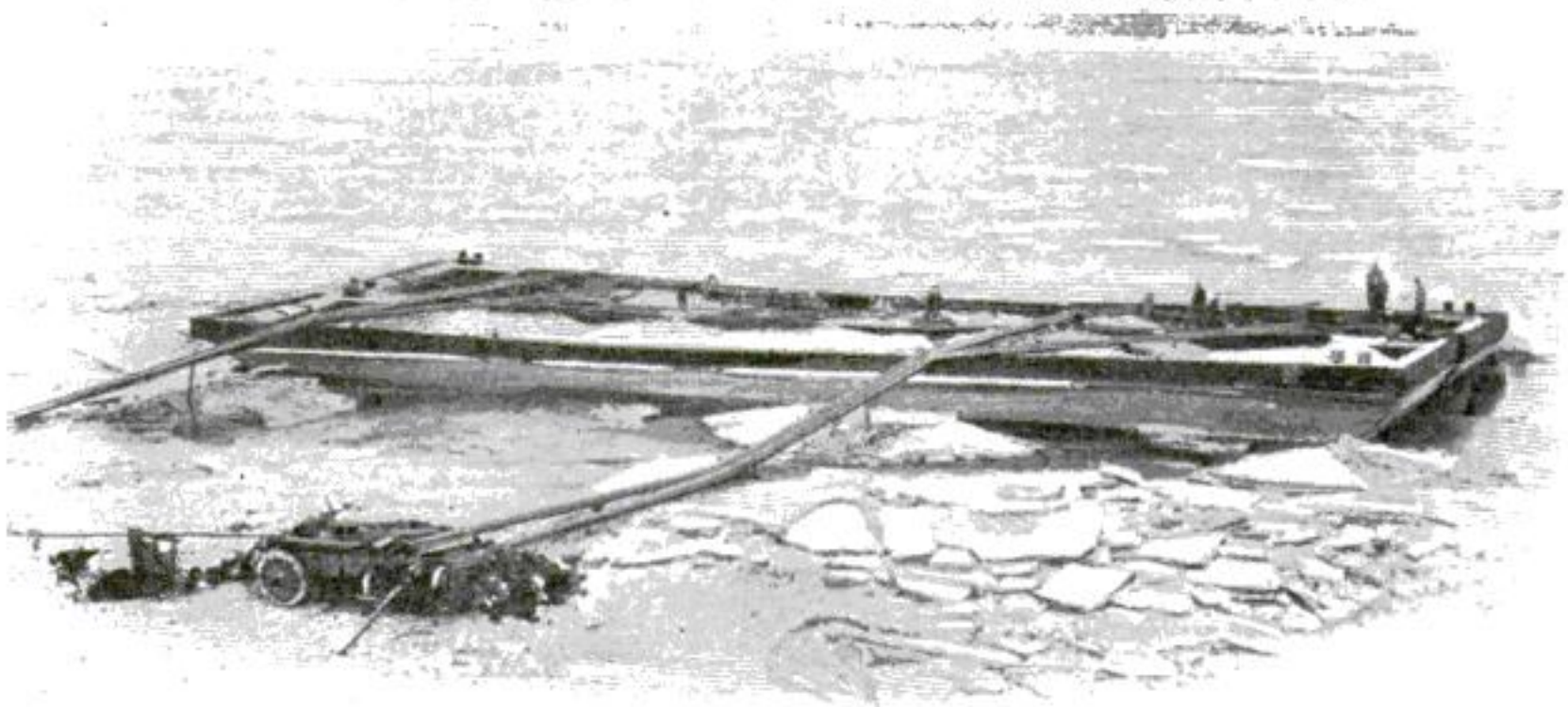
taking a Pullman at New York when you go to Chicago by the Pennsylvania, for instance, you ride in a day coach to Pittsburgh and enter your sleeper there. Pullman chair cars on daylight trains are limited to one car per train. An exception is the famous Congressional Limited, between New York and Washington, which formerly carried only Pullmans and made the run in five hours, but which now carries four Pullmans and six day coaches and takes six hours for the trip. Observation and club cars have been cut off; diners are hauled only on important trains, and then only for the shortest possible distance.



Showing the railroad lines that converge at New York. Situation is complicated by the Hudson River and, at present, by ice

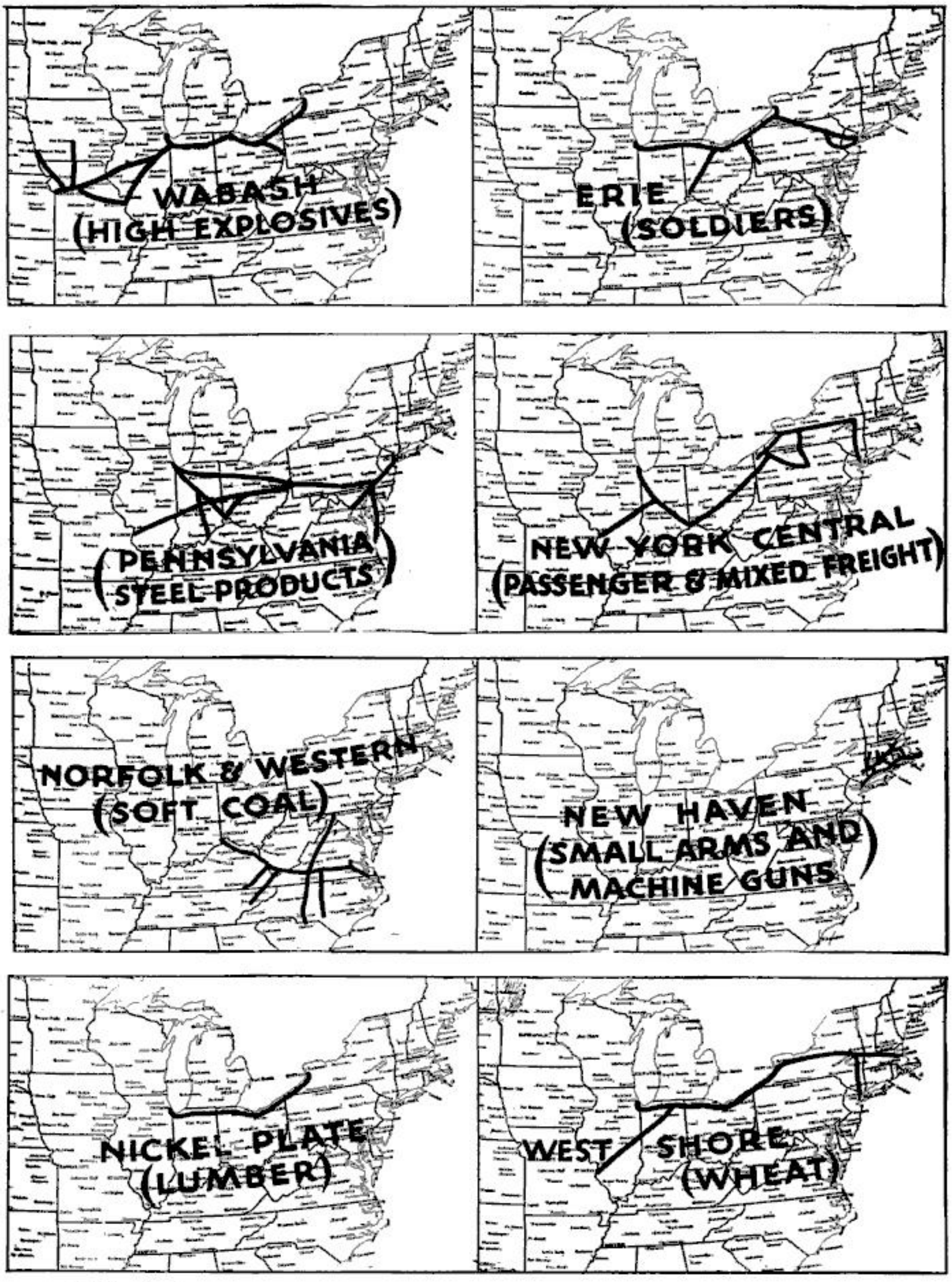
"Put the punch in car movements," is the slogan adopted by the railroads—and freight cars are what is meant. Demurrage rates, or charges made against consignees for failure to unload cars promptly, have been doubled by Mr. McAdoo's order. The roads no longer have to return freight cars to the lines that own them, but treat "foreign" cars as their own and load them for any points to which they have freight to ship. The unlimited pooling of freight cars is already relieving the car shortage situation greatly.

The next big step, for which plans had been drawn early in January by the advisers of the Director-General, was the further elimination of competition between the roads by arranging to have certain kinds of freight carried by one road, other kinds by other roads, and all the facilities of each line centered on the most



Cincinnati coal barges caught in mid-river by an ice jam. Citizens crossed treacherous ice on boards to get at the coal. All the country has gone to such lengths to escape freezing

What Railroads Are Now to Carry



Under the Government plan of operating the railroads of the country as a single system, each line will be required to do the particular kind of hauling for which it is best equipped

A number of these big Russian locomotives of 5-foot gage, built in this country, are now being adapted to our 4 ft. 8½ inch gage and used on our own roads. Two hundred will be used

expeditious movement of its particular classes of commodities. The accompanying map-diagram, showing how the nation's railroads converge at the Atlantic seaboard, indicates how freight and passenger traffic may be divided among the various lines. The Lehigh Valley road, for example, already brings to New York more flour than any other railroad. Its terminals at Buffalo and Jersey City are equipped for the handling of flour on a huge scale. The logical extension of this existing condition will be to divert all the flour traffic from other roads to the Lehigh, and if its terminals are insufficient it can use the Lackawanna terminals, which also have equipment for the repacking and handling at tidewater of flour for export; for under the Government's rulings, every road's terminal facilities are open to the use of every other road that needs them, just as the rolling stock and motive power are interchangeable. Five important railroad systems tap the hard coal region of Pennsylvania. Some haul coal from the eastern part of the field to the West, others haul it from the western part of the field to the East. This crossing of coal shipments has been stopped. The Norfolk & Western, for instance, could be diverted entirely to coal traffic, except for a small amount of short-haul local passenger traffic, while all other freight originating on its lines could be well handled by other roads. Plans tentatively proposed would make the huge Pennsylvania system exclusively a freight road, mainly for steel and its products, except for local passenger traffic between points not well served by other lines.

Car-loads are already nearly twenty per cent heavier than they were, due to the system of intensive loading urged upon the roads by the Railway War Board before the Government took charge; trains are ten per cent longer. Still there is a great shortage of locomotives. A list of questions sent to the heads of all the railroads late in 1917, asking what their greatest needs were, brought forth the almost unanimous response: "More locomotives." Many of the roads had not been earning enough to buy the locomotives they needed, especially at the 50 per cent increased cost due to war conditions; all the locomotive builders in the country, too, had been busy on huge foreign orders, notably for Russia.

Within a day after the Government took over the roads 100 brand-new locomotives, bearing the letters "U. S. A." on the sides of their tenders were placed in service on several Eastern lines.

These locomotives were not built for American service, however, but are part of an order of 980 locomotives bought by the War Department for use on the American roads in France which are being constructed to transport men and supplies from French ports and bases to the American sector of the fighting line. These Government locomotives are soon to be supplemented by 200 locomotives built for the Russian government, part of an order of 2,075 all of which will be completed in American shops by July.

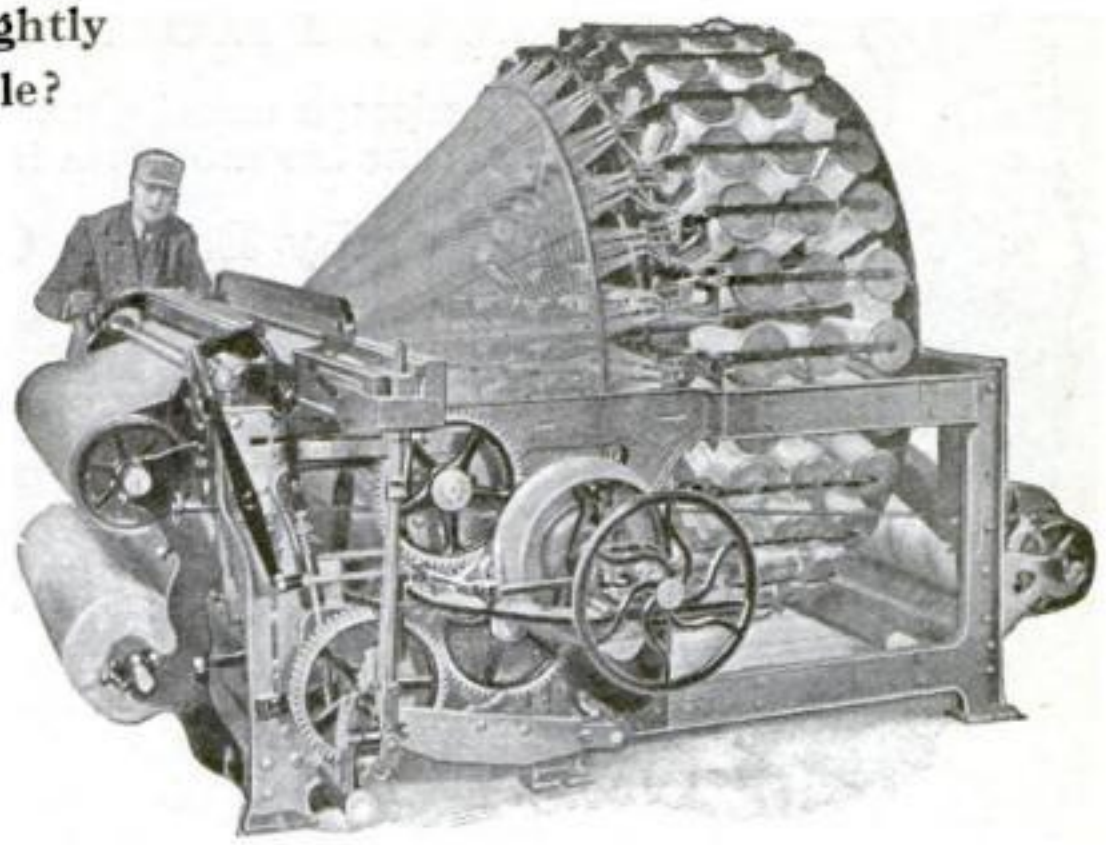
Why You Receive Popular Science Monthly Late

So great is the congestion of railroad traffic, that the delivery of Popular Science Monthly and other magazines is very irregular, and generally much delayed. During the next two months, owing to the "Fuel" holidays, still more delay must be expected. We are sorry. Please be patient.

Why Not Take Your Nightly Rest in Your Library Table?

NOT so many years ago, when apartment dwellers first began to feel the pinch of space limitation in their diminutive quarters, combination furniture was all the rage. Anyone visiting a flat dweller could never feel quite sure whether the book case he admired in the parlor was really what it seemed to be or a bed in disguise. Beds are such cumbersome things. Put a bed in a room and the room becomes a bedroom, the privacy of which excludes outsiders as a matter of course. From the very beginning, inventors have therefore concentrated their efforts upon the problem, how to disguise the bed, as it was clearly impossible to eliminate it altogether. Some of the attempts were quite remarkable, but few were practicable. Rather original is the combination of a library table and bed shown in the picture, an invention by E. T. Bronsdon, Chicago. By a few simple operations, the solid-looking library table in the parlor or studio can be changed into a comfortable and sanitary double bed fitted with sagless springs and felt mattress. This seems to be one of the most practical suggestions, so far, for saving space.

A few simple operations convert the table into a comfortbale bed



The loom that weaves a diagonally reinforced fabric is a complicated piece of machinery, yet remarkably compact

A Fabric With Diagonal Reinforcing Threads, Useful for Automobile Tires

THE urgent need of a cotton material which will meet the requirements of a tire foundation (flexibility, strength and resistance to strains in the direction of the threads and diagonally) stimulated Mr. William G. Trautvetter of Paterson, N. J., to invent a loom by which it is possible to weave a cotton fabric with diagonal reinforcing threads. The picture shows the perfected loom, which is remarkably compact.

The diagonal threads are carried in spools mounted in a large reel. As the reel revolves, the threads of the upper half are moved across the fabric in one direction, while those of the lower half are carried in the opposite direction, diagonally across the fabric. The filling or weft threads always pass under the warp threads, and over the bias threads. Since the diagonal threads are interlaced with the warp threads, while the weft threads are intermeshed with the warp and with the diagonal threads, a fabric is produced which is remarkably strong in every direction.

The rifle is growing bulkier as its uses increase

Indirect Fire from Springfields

A periscope attachment and a twenty-five-shot magazine are two of the important improvements

By Edward C. Crossman

PERISCOPE attachments for the rifle are an old story from the days of 1915 when Tommy Atkins put a rude contrivance of sticks and pocket mirrors on his Lee-Enfield and went to potting at the Germans across the way. Periscope, in case you've forgotten, means in this connection merely an arrangement of two mirrors, one up in the line of sight on the barrel of the rifle, the other down at the level of the eye, well below the trench parapet, enabling the soldier to aim and fire the rifle while remaining far below the line of the barrel.

The new combination developed by our Army Ordnance Bureau is put on without permanent alteration of the rifle. Our Ordnance Officers look with jaundiced eye on anything for the rifle that entails machining or alteration of the gun.

The periscope is so mounted that the shooter can stand below the lip of the trench parapet, protected from the overhead fire of shrapnel, which is not true of all periscopes. Also it is so hung that the recoil of the rifle swings the lens away from the eye, instead of pushing the shooting optic all over the face as is the case with some periscopes. An extension enables the trigger to be pulled from the level of the shooter.

The second point is that the rifle is fitted with a twenty-five-shot magazine instead of the customary five shots of the service rifle. The change is made by merely sliding the present floor-plate out and sliding the top of the frame of the new magazine into its place. This enables a great number of shots to be fired without taking the rifle down to reload. The Germans are said to have fitted up a number of their Mausers with these large capacity magazines some time ago. There is without doubt, much need for greater capacity than the present five-shot, clip-loading magazine.

The third novel point about the converted rifle is the use of translucent rear sight, colored red or green. The front sight is colored the one or the other of the contrasting colors—green when the rear sight is red, and vice-versa. The inventor, trying out his rifle in actual trench fighting, found that with the ordinary metallic sights, showing, of course, merely black in silhouette against a mark and hard to distinguish, the rifleman could not always define the objective, as the greenish uniform of the German soldiers did not throw them up in sharp relief. Often mist confused the issue still more. So he evolved the contrasting front sight, a vivid green or a violent red.

The advantage of the translucent slide is that it does not cover up the mark, and enables the rifleman to pick it up much more quickly than is possible when using the steel slide with the small aperture of the service rifle. This should prove very valuable in trench fighting.

The trigger is pulled from the level of the shooter by means of an extension mechanism

Germany Plows With Electricity

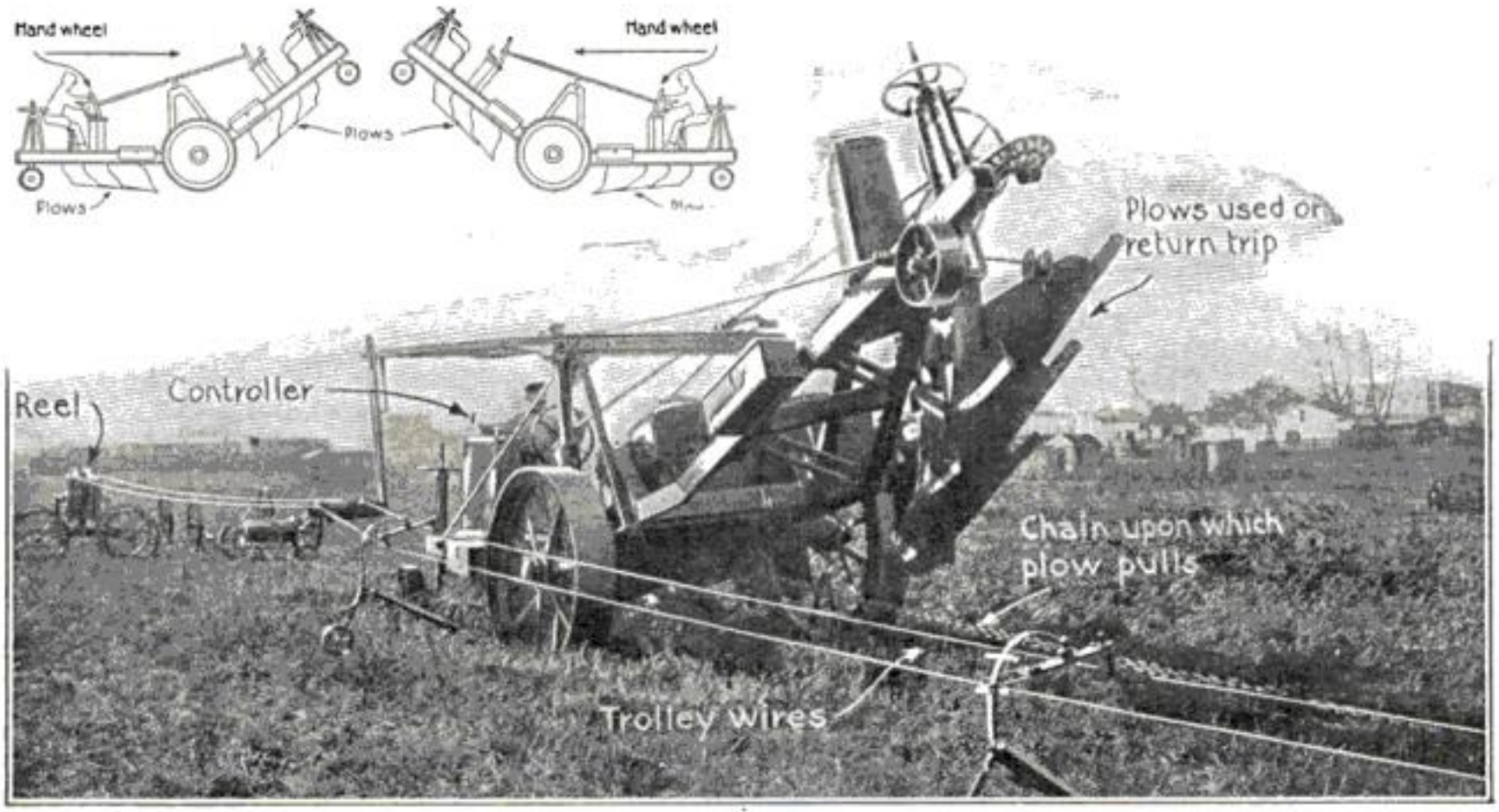
Men are becoming so scarce that all mechanical helps possible must be used

TO such straits is Germany reduced for men that she must make maximum use of the few who can be kept at home to till the soil. Her difficulty may be conceived when it is considered that even in time of peace women had to plow, sow, and reap. Now she has been compelled to adapt electricity to farm work. In the accompanying illustration we show an electric plow presenting many uncommon features. Old Hans, sitting at the far end, one hand on a steering wheel and the other on a controller, regulates the speed of the driving motor. This motor turns a drum, over and around which passes a chain stretching clear across the field and anchored at the other end. The chain simply goes around the drum and then passes out at the back, remaining in place until the machine again passes the point, on the same principle as the familiar capstan on a steamer.

Current is delivered by means of two trolley wires supported at short distances along the ground. Reels at each end of both the trolley wires and the chain keep all three reasonably taut. The reels are mounted on little carts, so that they can be moved sidewise as operations proceed and the amount of plowed ground increases.

The machine does not need to be turned around at the end of the furrow. Hans simply draws the plows he has been using up against the frame and adjusts certain levers, whereupon the end he has been using rises and the other end descends. He then climbs to that end, releases the trip of the other set of plows which it carries, reverses his motor, and is ready to go back again, the drum this time pulling the other way on the chain lying along the ground. Use of this chain apparently gives better traction than would ordinary driving wheels.

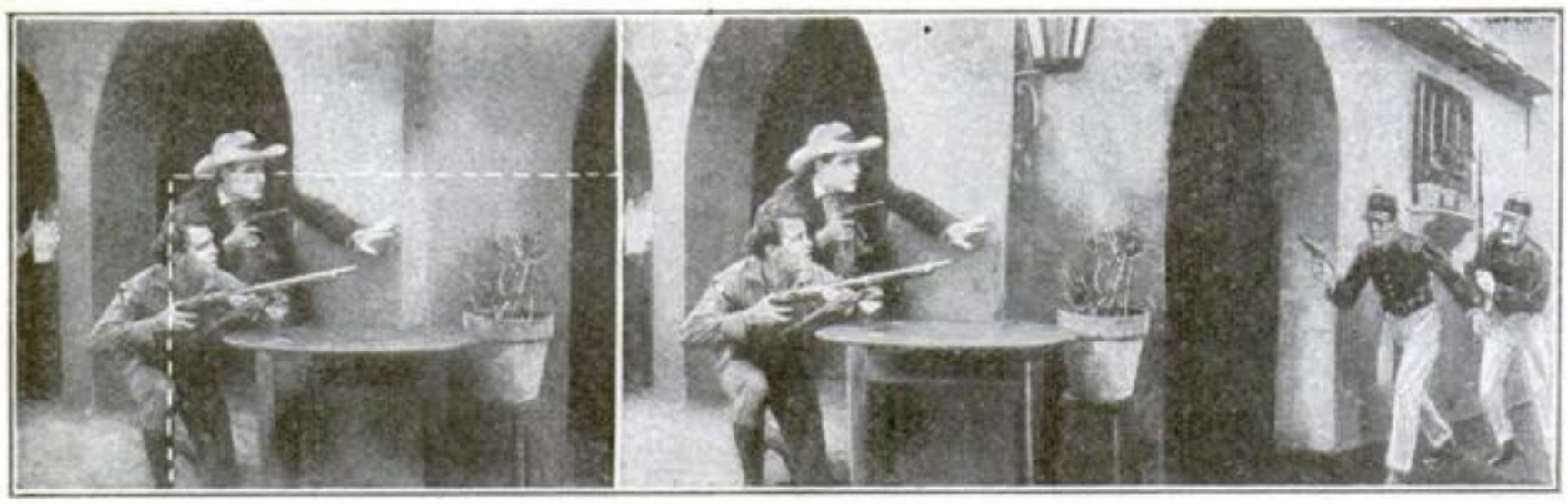
This plow contains many ideas of interest to those who follow tractor development. The caterpillar tread is one way of getting traction on soft ground. This chain plan, however, would seem as good, or even better, in special kinds of plowing, owing to its smoother action and the very positive drive.



Hans has a great time plowing with his electric plow. It looks complicated but is quite docile. How he turns around at the end of a furrow is indicated by the small sketch

Giving the Motion Pictures a Larger Frame

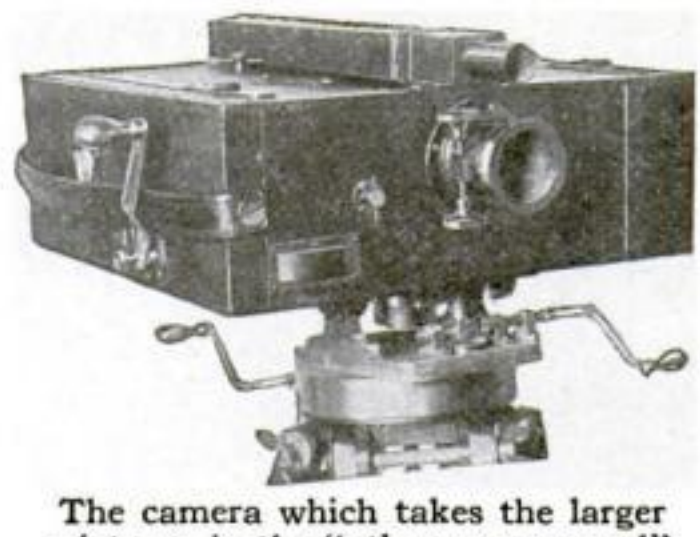
Each picture will be one-third higher and one-half wider than the old standard size



The white line divides the old style film from the new, while the dotted line indicates its size in proportion. One "sees around corners" with this device

A NEW form of motion picture which moves horizontally instead of vertically and uses a picture twice as large as the present standard has made its appearance.

The new picture, made on the standard motion picture film, is exactly twice as wide as the present picture is high, and its height is equal to the width of the present picture. This will give a picture on the screen of a different proportion from that now shown—one-third higher and one-half wider. The present picture is in the proportion of three to four and the new picture will be as four is to six. This is accomplished by running the film horizontally and using two "frames" for each picture. Only a limited number of large theaters will show the pictures. The screens of these theaters will be increased in size to twice the present area. The figures of the actors will be as large and even larger than those now projected so that an immense breadth of action is obtained as compared with the present very limited "stage."



The camera which takes the larger pictures is the "other way around"

The process is controlled by W. W. Hodkinson. He counts on a great addition to the directing and production of pictures through the use of the larger "stage" and believes that after the public has seen the larger picture, it will look upon the old film as it would on the necessity of looking through a knothole at the stage of a legitimate theater and show a marked preference for the new.

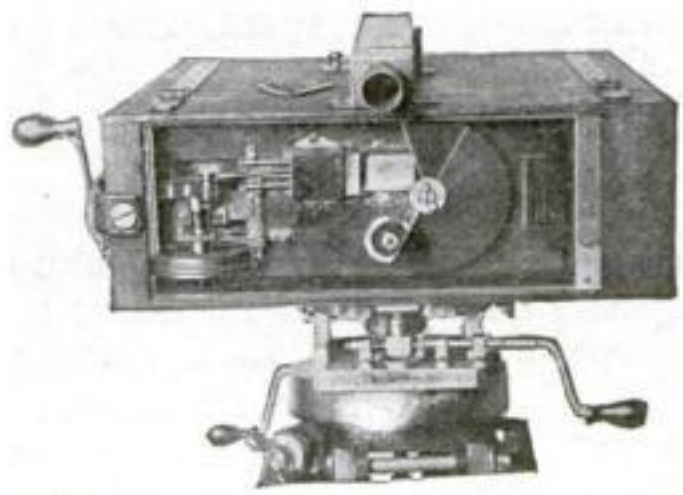
Mechanically the new process is extremely interesting. Standard lenses are used in the photographing. There is consequently no loss of light. The camera is so gaged that with the standard lenses a tremendous depth of focus is attained.

The projection machines used in the new process are a tremendous improvement over those at present in use. A flickerless picture has been attained through simplification of parts on the projector and introduction of new shutter principles.

The amount of film used for each picture will not be doubled. The larger screen, in which more can be shown, will obviate the necessity of the "cut backs" which are now used to show simultaneous action.

The new process of picture making is the first great improvement in the method of making motion pictures which has been introduced in the business, and it bids fair, in time, to revolutionize it.

For nearly twenty years the industry has used the same film and the same size picture which were introduced in the first years of the century as the standard product. In these years magnificent motion-picture theaters have been built, fortunes have been spent in the salaries of stars, and the cost of settings and directors has soared into the hundreds of thousands per picture. The presentation method, however, has stayed in the old channel, and the old film size, which was designed for cheap "nickelodeon" theaters has continued.



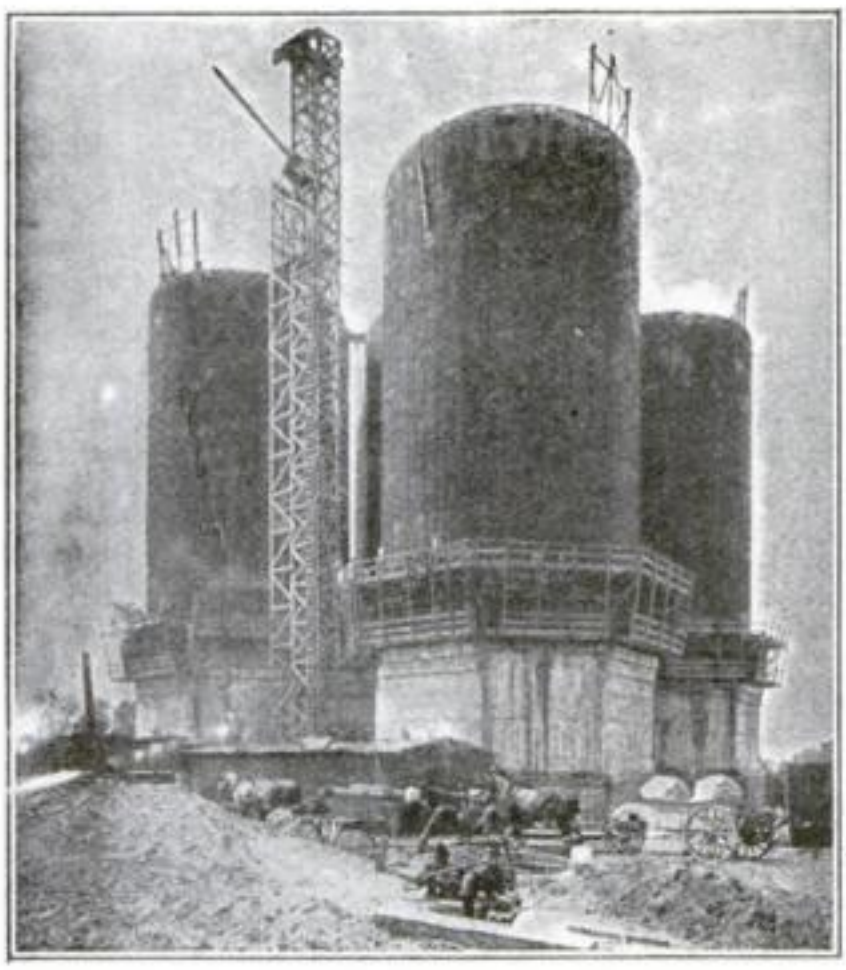
Camera showing the lens removed

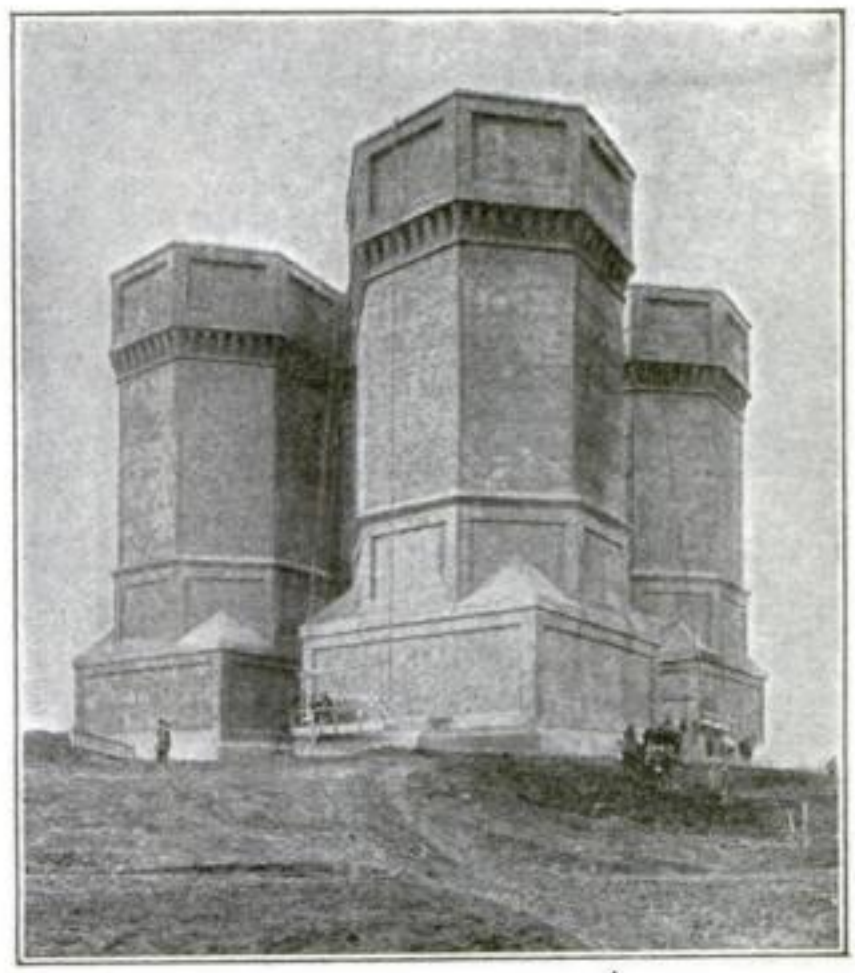
The new process is being introduced, its sponsors state, in order to get up a standard of quality by which the public can judge the pictures it wishes to see. It is stated that the new process, which practically controls this size and shape of picture, will be used only for the highest class productions. Producing franchises will be given to the manufacturers of all high-class pictures and steps taken to gain their interest. Once the new style of pictures become known to the public, they will certainly become popular.

Turning an Eyesore Into a Dignified and Imposing Structure

AGAIN it has been proved that even a strictly utilitarian structure need not be ugly. In Cincinnati, some unsightly steel water standpipes have been placed in an architecturally pleasing concrete shell. Now the residents of the neighborhood see a concrete industrial monument instead of hideous, painted metal cylinders. The utility of the tanks has not been injured in the least, so the strictly practical business man need not object.

The reservoirs were filled with water before the shell was built. Had they been left empty, slight changes of shape might have occurred when the water flowed in, with the result that the concrete would have cracked. The forms to hold the concrete around the base of the tanks were braced to the foundations, while the higher forms were raised on derricks which were manipulated from floats on the water surface within the tanks. The result is a landmark of pleasing appearance.





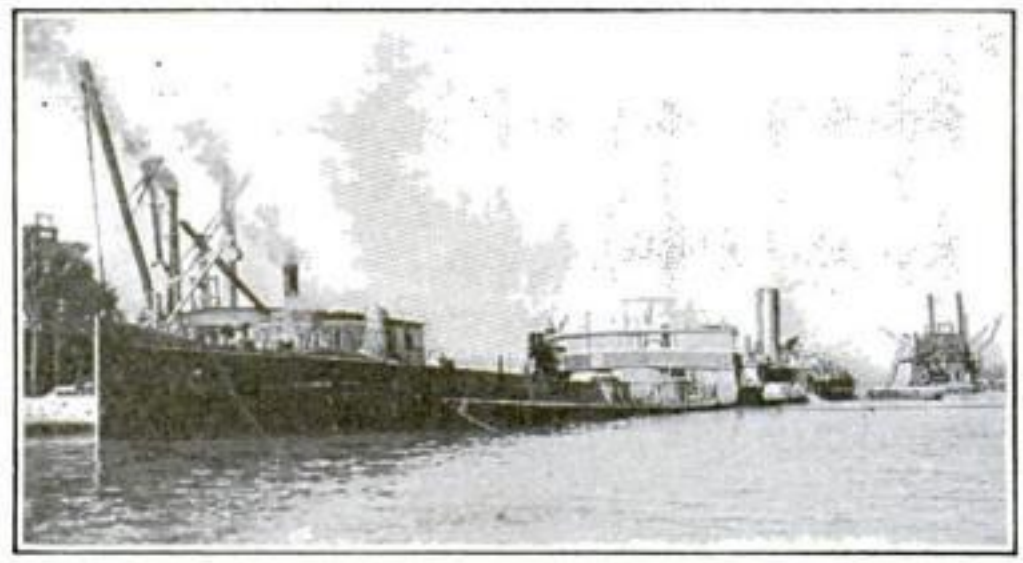
Before: The unsightly tanks as they looked at the beginning of their metamorphosis
After: The dignified and imposing castellated structure at the finish of the operations

Making a Million Out of a Sunken Ship

The problem of the *Gut Heil*, a German tanker that lay on her side at the bottom of the Mississippi

By Robert G. Skerrett

FIVE years ago, a double collision sent the German tanker *Gut Heil* to the bottom of the Mississippi a half mile below Baton Rouge, as she was outward bound with 3800 tons of oil. As a ship, she was worth about $300,000; and $125,000 was spent afterwards in an unsuccessful attempt to refloat her. Today, thanks to extremely clever salvage engineering, the craft is afloat and valued at not less than $1,000,000, mainly because of the scarcity of ocean-going bottoms.



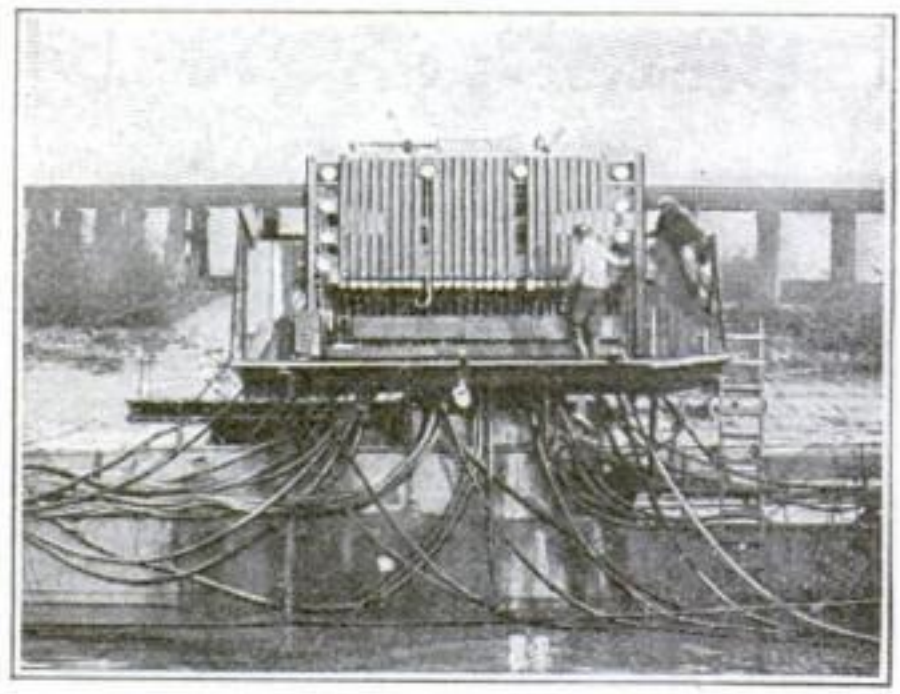
The *Gut Heil* rejuvenated; ready to float out of the muddy Mississippi and into the Gulf for refitting

As the vessel was not held in hand, so to speak, when wreckers first tried to raise her, she turned over while partly afloat, filled with water, and sank on her side. In that position the task of raising her appeared hopeless, and so she was abandoned by her owners. A few months ago interest was revived in her, and a well-known New York salvage company was asked to make another effort to recover her. After preliminary study the work was undertaken as it was believed that the difficulties could be circumvented and the vessel successfully refloated.

As she lay submerged, the *Gut Heil* represented a dead weight of 6,000 tons, 4,000 tons of the burden being in the form of mud that had displaced her cargo of oil. How was it possible to get rid of that load of accumulated silt and then make the ship right herself? Past experience made it clear that she would have to be controlled perfectly at every moment. If she acquired too much momentum at the start the impulse might carry her far enough over on the other side to allow the water to rush into her and to cause her to founder again.

To get the mud out of her, the salvors devised a siphon operated by compressed air. It did its work well. Her fourteen oil tanks were fairly well cleaned out, so that it was possible for the divers to examine her condition. They reported that her main longitudinal bulkhead, reaching nearly her whole length, was not tight where it met the metal deck above. Since this had to be tight it became necessary to seal the long divisional wall of steel. This was done under water. Divers made a union between the bulkhead and the deck with reinforced concrete. They also closed the two wounds in the tanker's side with the same material.

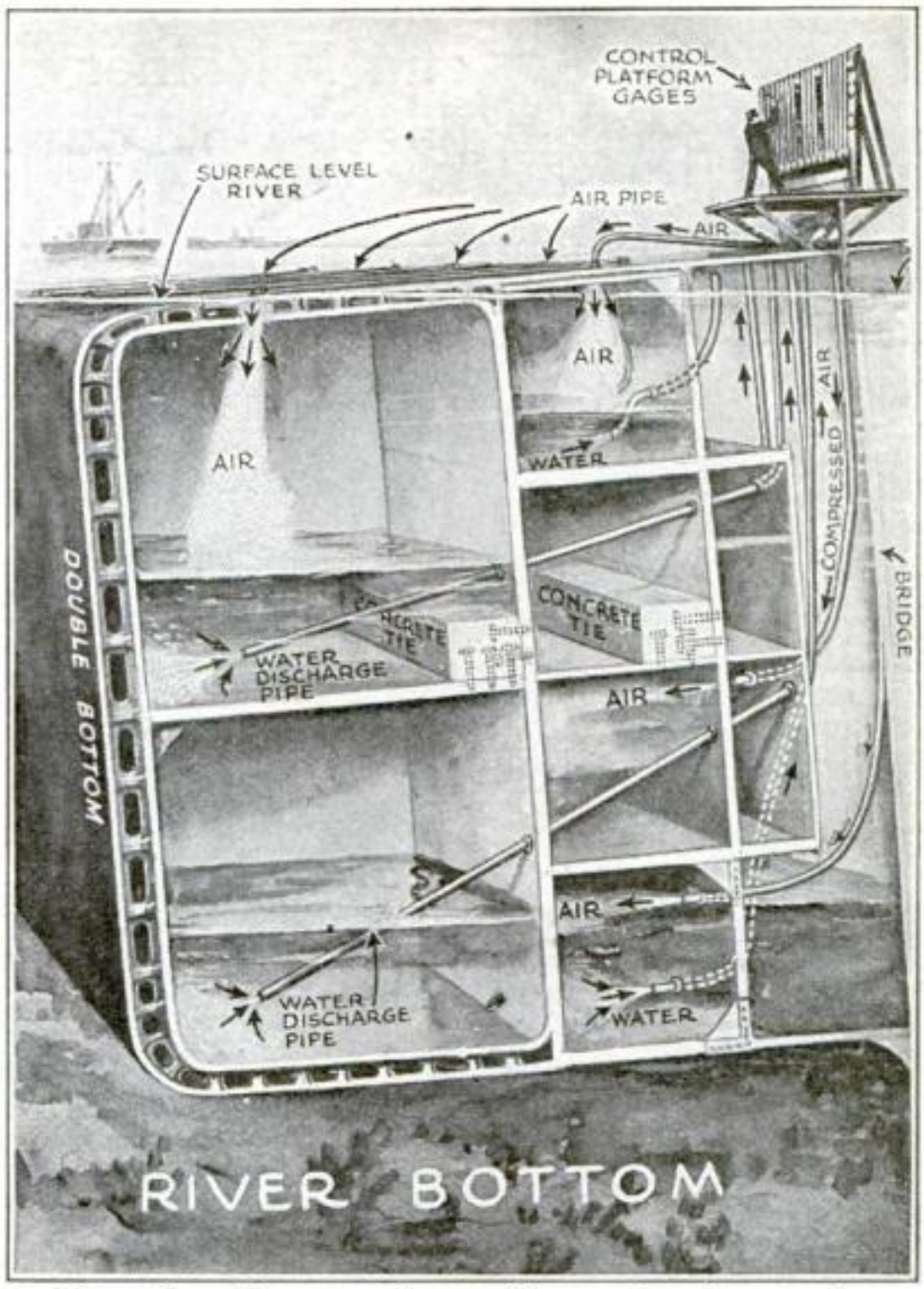
The vessel was blown out by com-



Here the master wrecker watched gages and controlled the raising of the *Gut Heil*

pressed air. To each compartment was led a flexible connection of hosepipe, and through these hoses the exact amount of air desired was fed. When the tanker became too buoyant and threatened to keel over on the other side, the air pressure was released so that the water could re-enter. In this way the ship was nicely controlled.

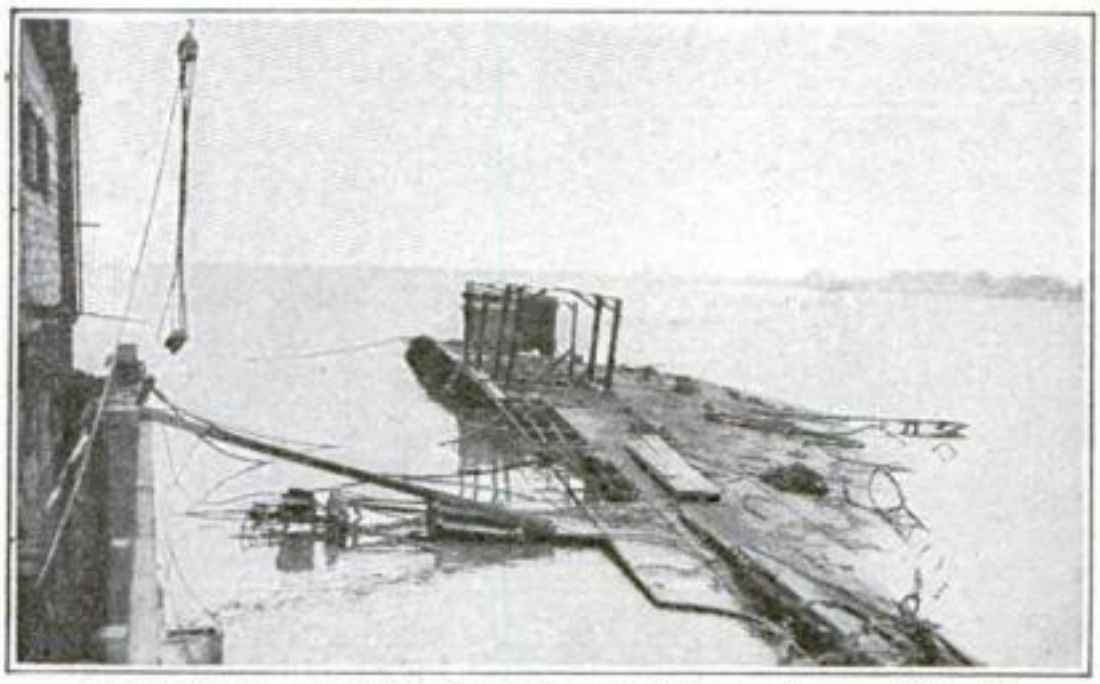
All of the pipes centered at a pivoted platform, arranged so as to maintain a horizontal position during the righting of the vessel. On the same platform was set a standing frame holding a double system of gages with the usual dials. One of these indicated the amount of compressed air available in the several reserve flasks, while the other one, consisting of tubular mercury indicators, showed the air or buoyancy in the different compartments of the craft. The wrecking master had a visible guide of the steamer's internal state and a complete index of the forces he was calling to his service both to move the *Gut Heil* vertically and to check or regulate her motion laterally. It was as easy as reading the time on a clock. Literally, by a hand's turn, he could juggle the air and water within the tanker so that the rising and swinging of her dead weight of many thousands of tons could be managed to a nicety.



How the raising was done. Air supplanted water in the various chambers of the ship, gradually floating her

Two months of careful preparation were required to get everything ready. The ship was then soon raised and righted. Indeed, turning her vertically and bringing her to the surface was but a matter of minutes. Her present owners, after allowing for all expenses, have netted a gain of more than $800,000, and the ship is in such excellent condition, in spite of her long submergence, that her engines will be able to drive her after they have been cleaned.

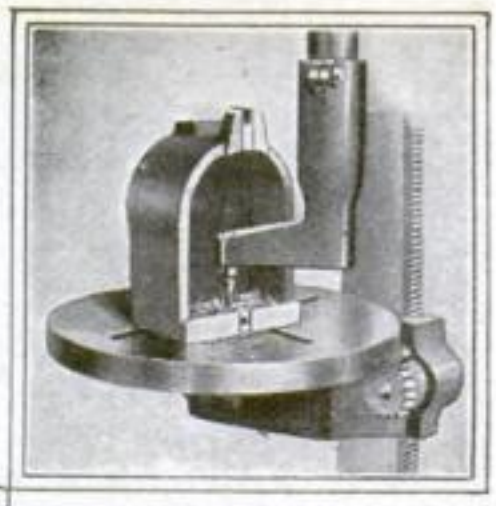
It is such exploits as the above that are making history in the annals of salvage.



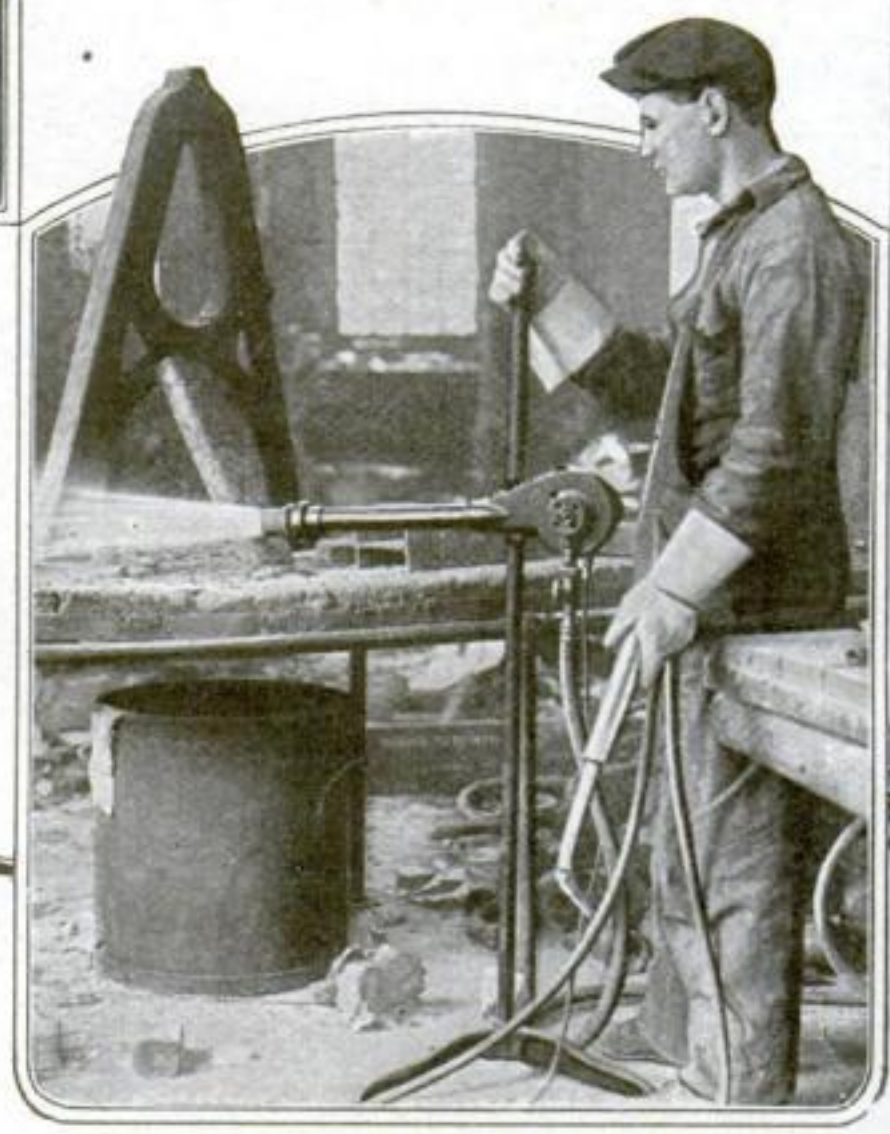
She lay on her side in mud, making salvage difficult. The water was blown out of her by compressed air

Do It with Tools and Machinery and Speed Up Your Job

The usefulness of this motor-truck is increased by side brackets, as shown



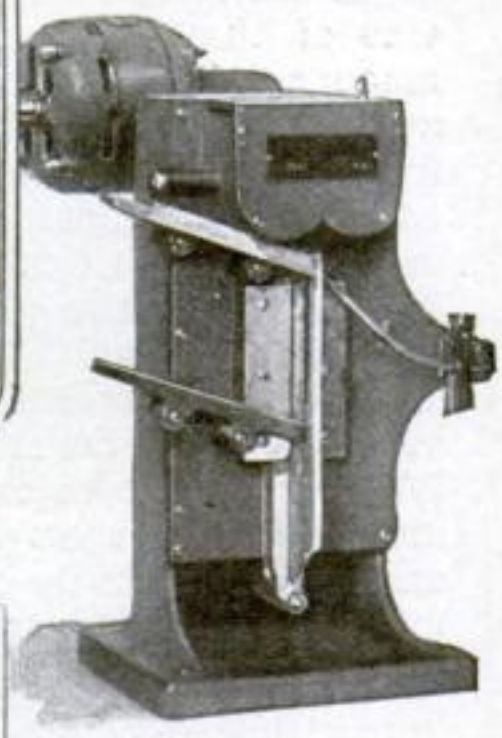
This attachment is for drilling in difficult places on castings and other work

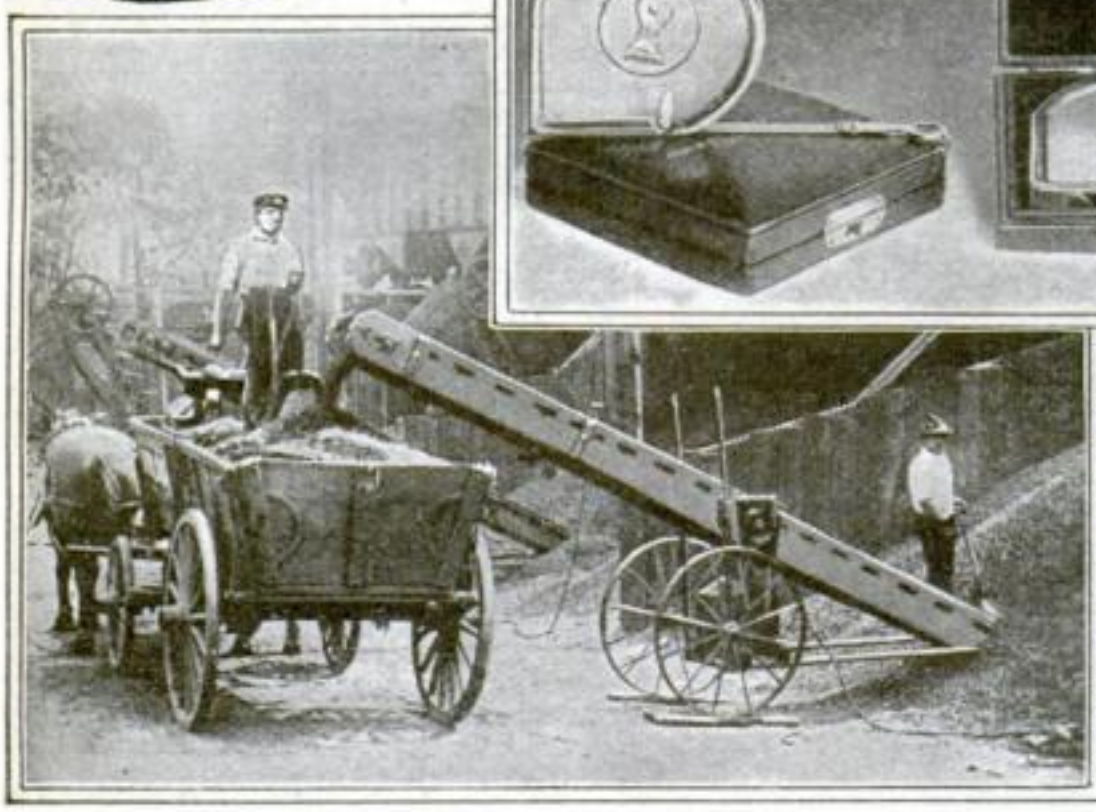


A gas torch in which an electric fan forces out the gases, making a flame up to twenty-four inches long

Machine for forcing out obstructions in hollow steel tools used in rock drills

Motor-driven machine for cleaning the space bands on linotype machines



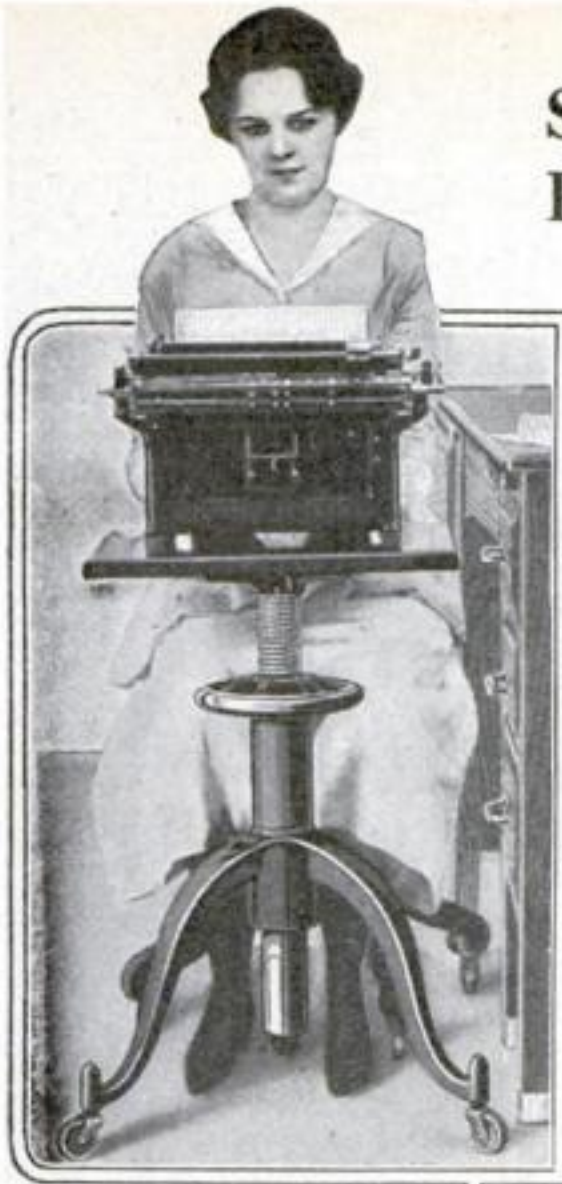


A new type of portable conveyor which is driven by an electric motor. The lower end has a scoop for pushing into the material

Above in center: A tape line which registers the length measured on a dial which is on top of case

A self-contained rock drill. It is worked by a small gasoline engine attached to the tripod used for holding the drilling machinery

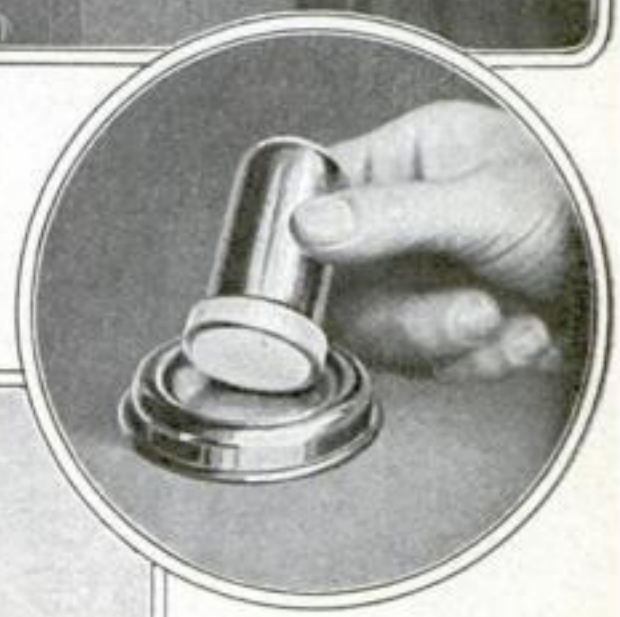
Some Little Conveniences For Busy Office Workers

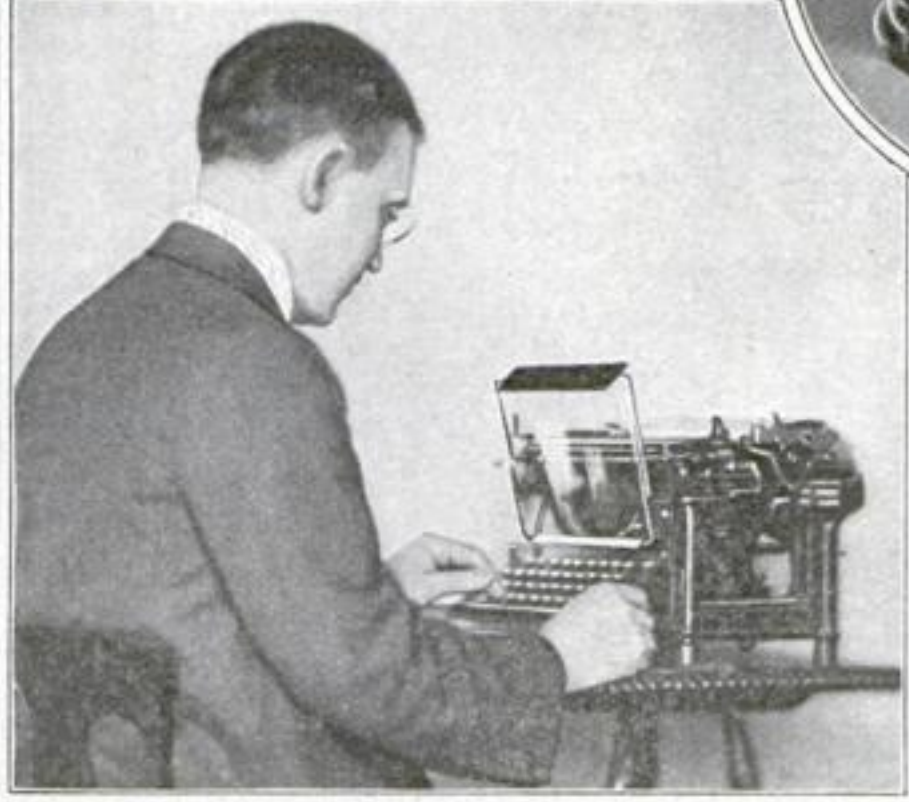


The typist who desires a stand of just the right height on which to place her machine should have one which can be adjusted like the top of a piano-stool

An arm for holding the telephone securely in any position. The arm incloses and protects the cord

Below is shown a typewriter equipped with mirrors to reflect the writing near the keyboard

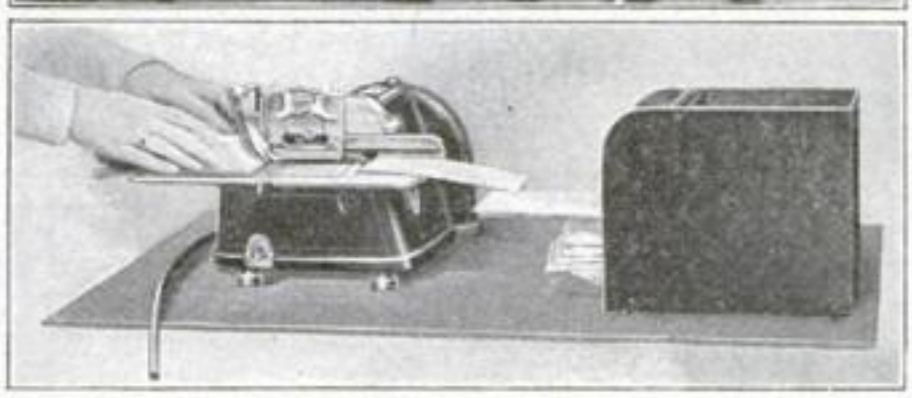


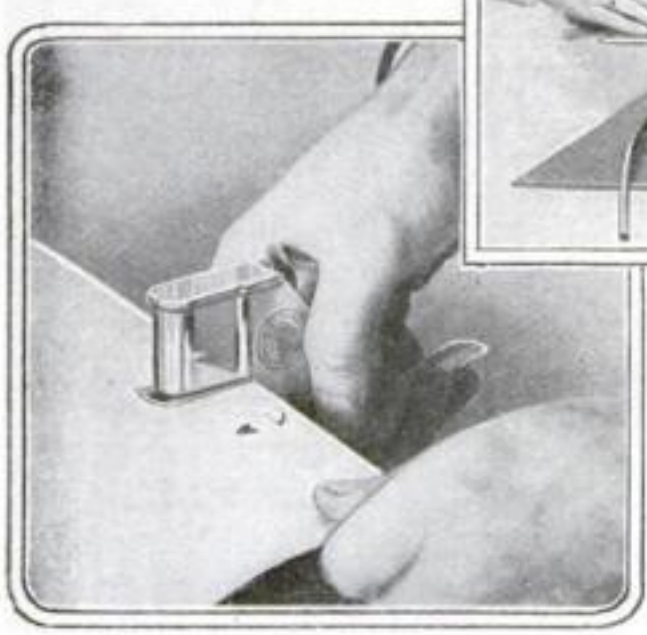


This moistener for sealing and stamping envelopes consists of a holder in which a damp sponge is fastened

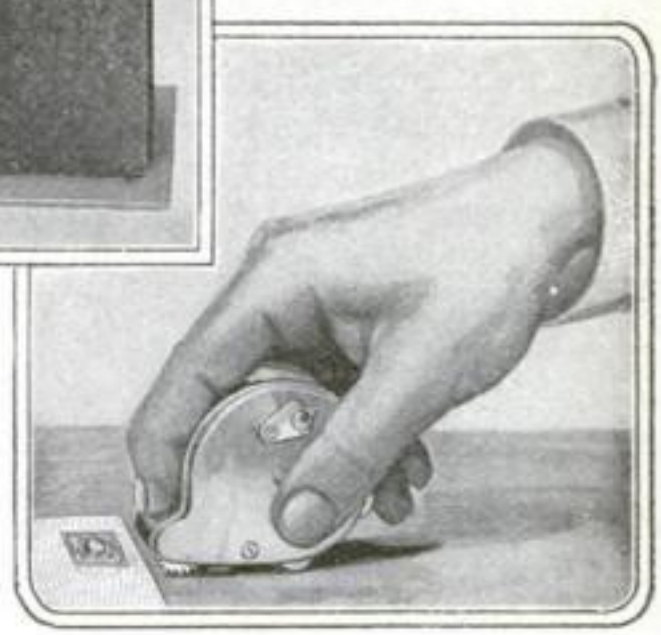
The little hand-machine shown below makes it unnecessary to use paper clips. It cuts, folds and clasps a portion of the paper to hold the sheets together like a clip

Below: A stamp affixer. The stamps are applied one at a time by drawing the device across the envelope





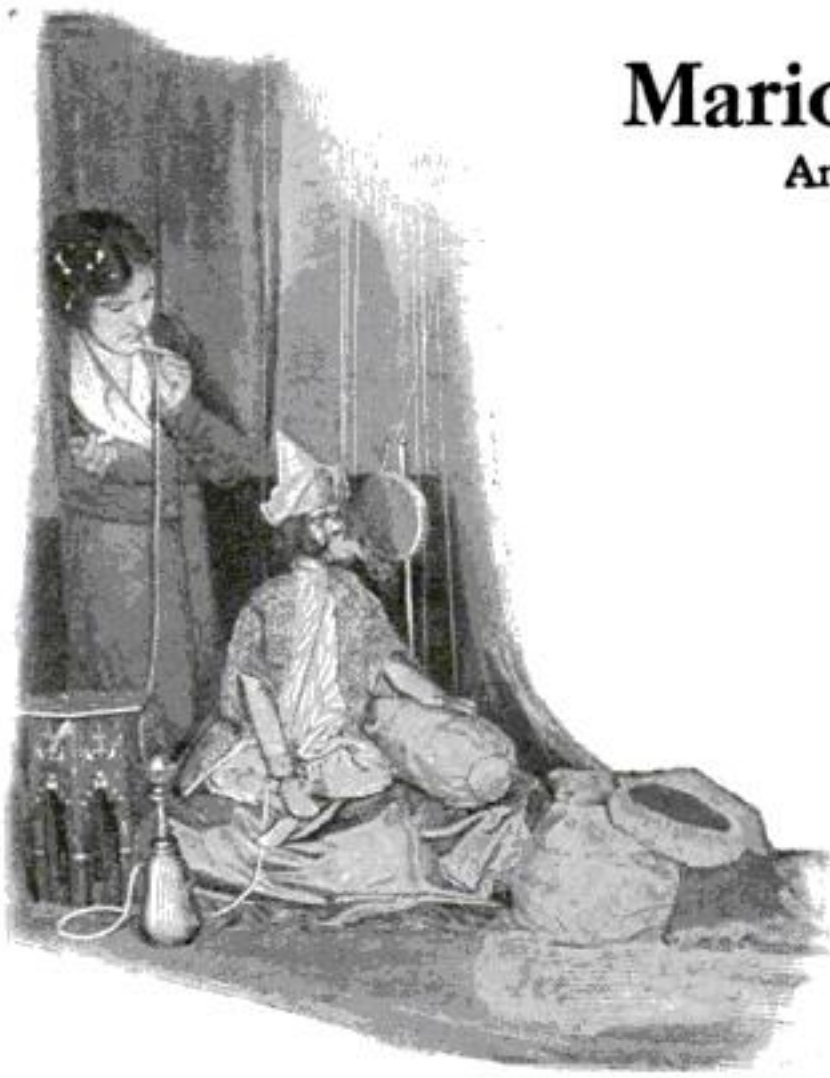
A small electric letter-opener. Only a small shred is cut from the edge of the envelope



Marionettes Extraordinary

An ancient art brought up-to-date

By A. M. Jungmann



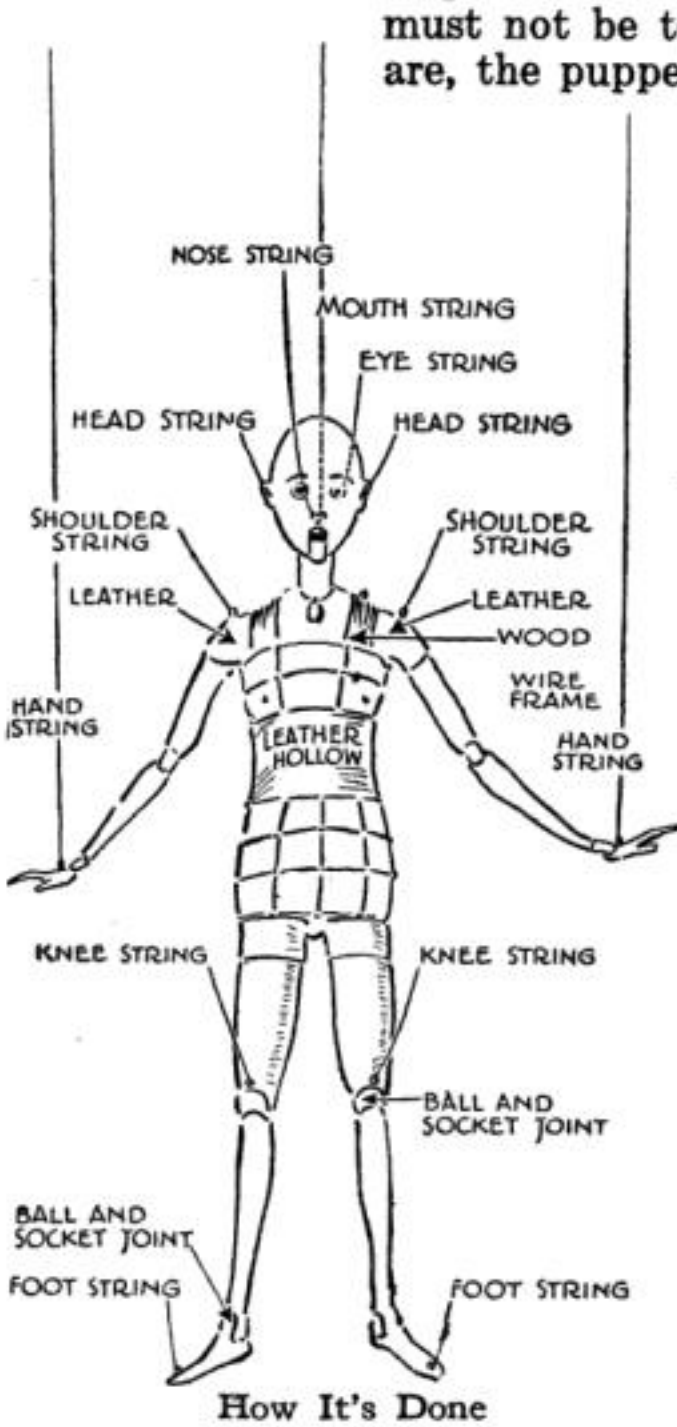
A Smoke by Proxy

This picture divulges to us the secret. The young lady, who stands in the wings, is responsible for the merchant's smoke. She takes a puff from a cigarette and blows the smoke into a rubber tube which leads into the puppet's mouth, and gives a very realistic effect

THERE is no telling what may develop from the hobby of a collector. The most life-like puppets that ever graced a miniature stage came into being just because an artist had the hobby of collecting toys. Some years ago Tony Sarg, a New York illustrator, began the collection of old-fashioned toys. He picked them up in all parts of the world. One day he came across a puppet which had been an actor in a puppet show. This little wooden figure, poorly designed and lacking in joints, gave Mr. Sarg an idea. Why not puppets capable of giving really good imitations of human beings?

This question was more easily asked than answered. But after several years' hard work on the part of Mr. Sarg, the puppets are here to speak and act for themselves. To design natural-appearing puppets requires, among other things, a knowledge of anatomy, mechanics, art, the principles of the drama, and the craft of the costumier.

One of the first points which had to be settled was the question of size. The average puppets are too small to simulate living human beings on the stage. On the other hand, it is possible to have the puppets too large. Mr. Sarg finally decided that puppets about three feet in height were the most satisfactory. They must not be too heavy, because if they are, the puppeteer cannot operate them. Finally, they must be constructed with joints which will enable them to move just as a human being moves.



How It's Done

If you are curious to see what makes the puppet act in such a life-like manner, examine this drawing. You will be able to see how its joints are arranged and how the strings the puppeteer so cleverly pulls, are attached to the joints

These puppets move, not only their hands, feet and heads, but their eyes and mouths as well. Imagine a puppet making goo-goo eyes at his lady love!

The design of the puppet is very ingenious. The head is fastened to the shoulders in such a manner that it can move forward, backward, and sidewise. The arms have ball and socket joints in the shoulders, elbows and wrists. One of the puppets, which takes the part of a singer, is built so that its chest rises and falls exactly as does the chest of a person who is singing. Movement at the waist is provided by means of flexible material, and the legs are joined to the trunk by

pieces of leather, which are so arranged that the puppet is able to imitate the natural movement of the hip. The knees and ankles both have ball-and-socket joints, but in the case of the ankles the movement is restricted so that it is impossible for the puppet to lose control of its feet.

The puppets are controlled by a number of fine strings which are attached to a little wooden device which looks a good deal like an airplane and which is called the controller. The number of strings necessary to control the puppet runs from fourteen to twenty. The string has to be very strong, yet fine because it would never do for the audience to see it. After many experiments, Mr. Sarg found that Japanese trout line is the most satisfactory material for the purpose. The line is very fine, not as coarse as the thread ordinarily used for sewing on shoe buttons, yet it will support a weight of forty pounds. Although all colors and combinations of colors have been tried, black is the color which is least visible to the audience. Experiments were even made in camouflaging the string after the manner of camouflaging submarine periscopes. But black has been found to have the lowest visibility.

Two bridges are built over the stage on which the puppets appear. The puppeteers control the puppets from these bridges. Each puppet has an actor who reads the lines. As the puppet moves across the stage, the actor follows it on the bridge. In this way the audience hears the voice always coming from the part of the stage on which the puppet is located.

It is very difficult to train people to be good puppeteers. The new puppets are controlled by girls. Learning to control a puppet is a good deal like learning to play

The Stage Director and the Always Pleasant Actors

A scene in one of the plays. Look at the stage director who is speaking to the puppeteers on the bridge above and you will get an idea of the size of the puppets. When seen alone they appear life-size, so cleverly are the furniture and the stage settings designed. The fearsome skeleton is arranged to fall to pieces on request

a musical instrument. Some girls can learn to operate the puppets in about two weeks, while in other cases it takes months to train them. The most difficult thing for a puppeteer to do is to make a puppet walk. The puppeteers are taught to walk the puppets with their eyes shut because it is so very important to have the puppet walk in a natural manner, that the puppeteer must accomplish this automatically. The feat next in difficulty for the puppeteer to learn is to make the puppets look at each other in a natural manner. The puppets can pick up objects, throw them down, and mount and dismount animals. In fact, they can do practically everything a person can do. It is far easier to make them dance than it is to make them stand still. When they are standing, they have a tendency to sway. The skillful puppeteer can prevent this, but it takes a great deal of skill to hold a puppet motionless on the stage.

The puppets have their own miniature stage with a miniature lighting system which is similar to that used in Broadway productions, even to the colored footlights. In order to prevent those of the audience who are sitting near the stage from seeing the strings, a frame is arranged in front of the stage, on which the trout line is stretched vertically. This screen of trout line effectually conceals the movements of the strings which are attached to the puppets. In writing a play for puppets, the lines have to be specially written to accommodate their movements. There can be no short speeches as there are in plays written for living actors.

Pulling the Strings

The rich merchant seated on his cushions enjoying a smoke. The young ladies above him are pulling the strings which make him and his fellow puppets act. The puppeteers are invisible to the audience

Among the company of puppets are dogs, rabbits, donkeys, and horses. In one of the plays a skeleton comes on the stage. It always amazes the audience by its acting of the supernatural. It is so constructed that it falls to pieces and pulls itself together again. This trick is possible for the simple reason that the skeleton has hollow bones through which strings are run.

This system of managing marionettes is, of course, a refined version of the old time method. Puppet shows in themselves are as old, almost, as acting by living persons. It will be remembered that Cervantes has an incident in his immortal satire, Don Quixote, in which that celebrated and chivalrous nobleman achieves lasting fame by routing the gang of scurrilous knaves who were abducting the fair damsel in a puppet show belonging to a strolling player, to the owner's great disgust.

Motor Trucks Pull Subway Cars

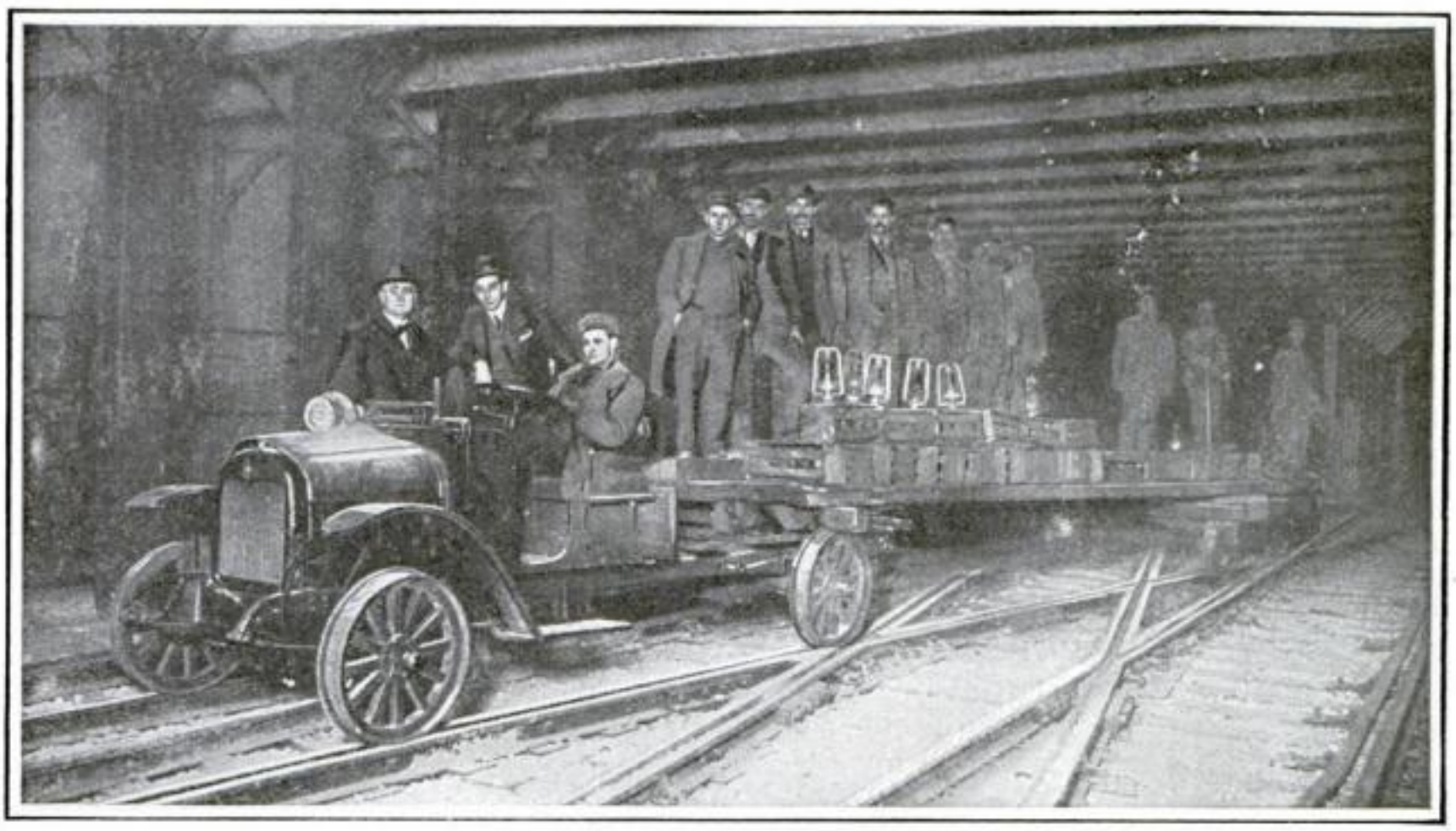
Construction work is facilitated by trusty gasoline tractors that rush materials where needed

MOTOR trucks are today running in New York's subways. To be sure, they are not carrying passengers, because the portions of the tubes in which they are utilized are not yet completed. Still, they are performing the very good service of rapidly transporting earth and rock, or bricks and steel, from one point in the system to another. The great amount of material which must be handled inside of the tubes may be realized when it is considered that the streets over the subway have to be kept open while the construction is going on. The torn-up portions of the roadway have to be put down just as soon as the concrete roof is finished, leaving the placing of the rails, switches, and signal equipment for a later time. In order not to impede street traffic, the shafts down which the material is dropped are placed as far apart as possible. This makes long hauls necessary inside the tube itself.

As the current will not be turned on in the third rail until the regular passenger trains are put into operation, the problem of getting long, sixty-foot rails and heavy switches to the proper points on hand cars seemed too formidable for solution. Finally the superintendent decided to use a regular motor truck fitted with flanged wheels. There was none of the smoke and steam that accompany the use of locomotives. Moreover the regular flat car was rendered unnecessary, because the motor truck was converted into a tractor with a fifth-wheel at the rear instead of the usual body.

Ten to fifteen tons of sixty-foot rails are in this way pulled by a one-ton truck. The weight of the front ends of the rails rests on the truck fifth-wheel and the weight of the rear ends on an ordinary hand car, as shown in the illustration. The fifth-wheel support enables the truck to turn curves and run over cross-over tracks just like any locomotive. The truck is furnished with a searchlight mounted high on a rod extending up from the dash. This and a regular truck horn give men working along the track a warning of the approach of the unusual vehicle.

This adaptation of the familiar motor truck has much facilitated the work.



A fifth-wheel is mounted on the rear of the motor truck. Rails and beams ride on it and on the small hand car in the background. There is no smoke, as with an ordinary locomotive

Did He Join the Army or Navy? This Service Flag Tells

ONE of our Jackies, Maurice Clement, the Quartermaster on the U. S. S. *Texas*, thinks that the conventional service flag which is now flying from innumerable windows all over the country, has one defect. It does not tell what branch of the service each man has entered.

Now Quartermaster Clement is extremely proud of being in the navy, so, when he came to make a service flag for his own home, he framed the central white space with a piece of white-line tied in attractive knots. At the top and bottom of the panel he made a double Carrick bend; at each side, at equal intervals, a figure eight knot, and then a square knot, thus making a balanced design.

This flag is not only very attractive, but it leaves absolutely no doubt as to what branch of the service it symbolizes.

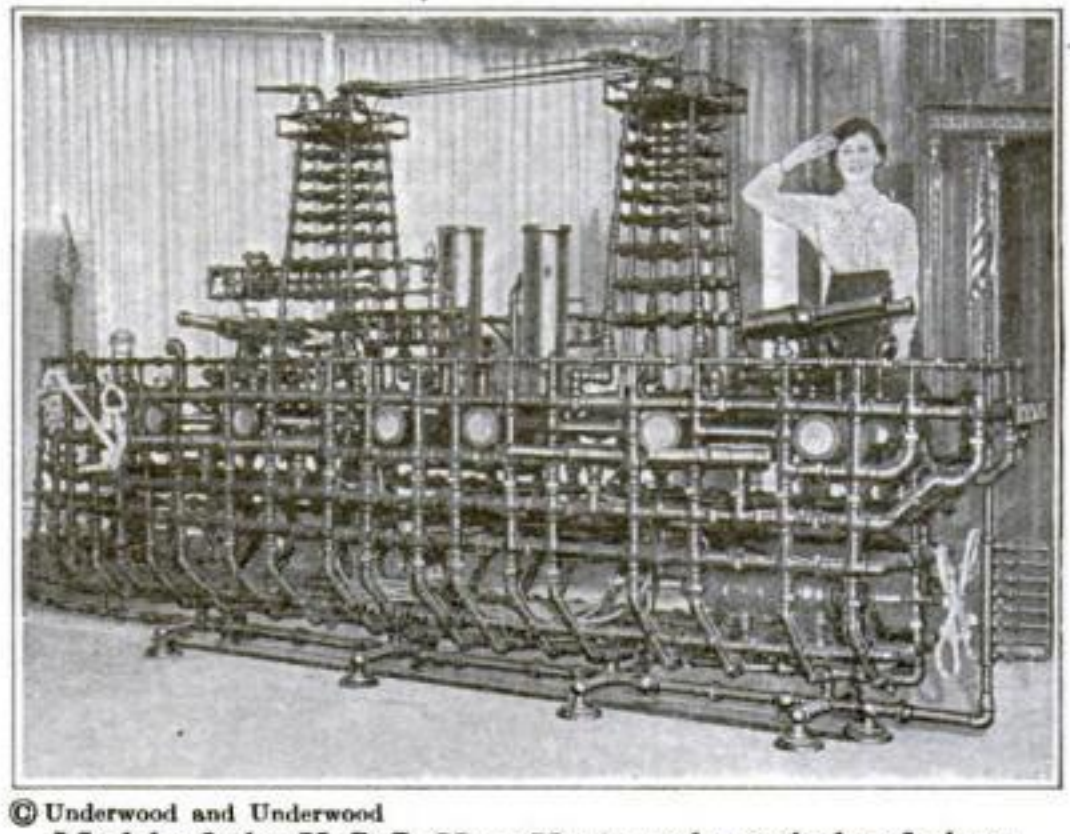
White-line tied in sailor-knots frames central panel of this naval service flag

The U. S. S. *New York* as She Appears in Pipes and Pipe Fittings

HERE'S a curious new battleship, a model of the U. S. S. *New York*, made entirely of pipes and pipe fittings manufactured by a prominent firm.

The boat is formed of forty-seven different kinds of pipe fittings, four types of valves, a brass whistle, oil cups and valve parts. It is electrically wired, so that its propeller revolves, its cannons fire, and its wireless apparatus emits sparks.

The man who conceived and built the vessel is Julius Gerion, a Belgian mechanic, employed in the company's shops at Bridgeport, Conn. He drew no plans of any sort, nor had he ever inspected a battleship. He simply copied photographs published in the magazines and papers. For ten weeks he worked at his toy, evolving it part by part. Six thousand, six hundred and sixty-nine separate pieces were used.



© Underwood and Underwood

Model of the U. S. S. *New York* made entirely of pipes and their fittings. It is the work of a Belgian mechanic

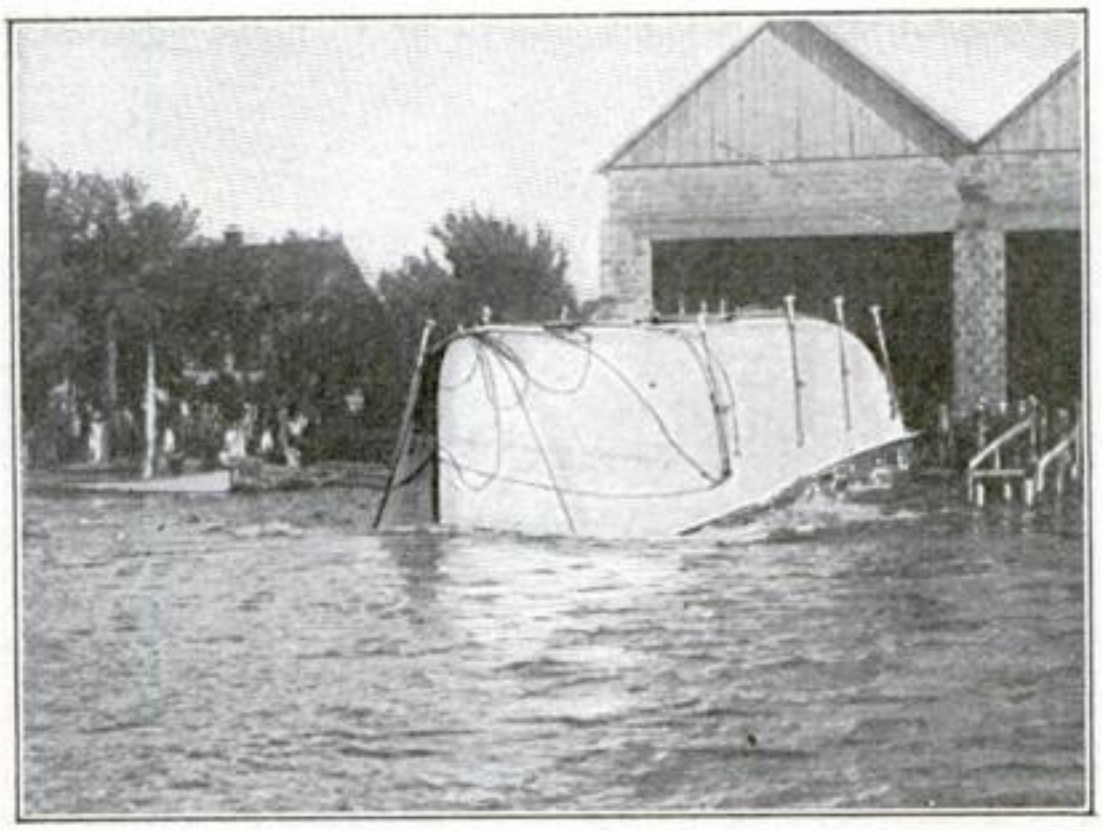
The Merits of the Wooden Barrel are Obvious

A BARREL can be rolled. This is its greatest merit. Every other shape of container which weighs over a hundred pounds when filled, must be lifted bodily and carried on a hand truck or by hoisting machinery. One man can unload a carload of sugar—two hundred barrels of it—in less than an hour. Don't you wish it were at your door? No other container can be handled at this rate, even by two men working at top speed.

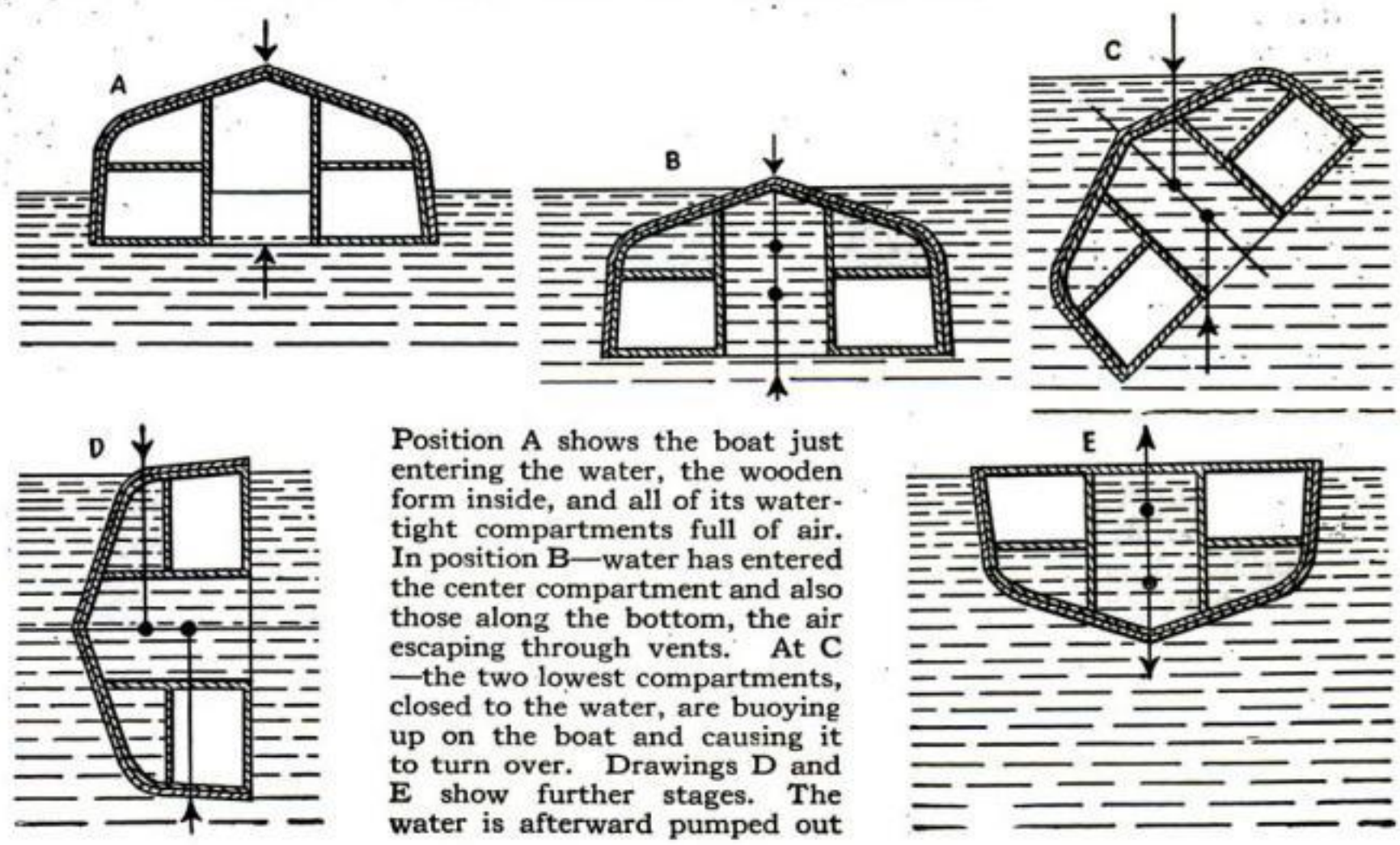
Launching Concrete Boats Bottom Up

Norwegians are shipbuilders of old. Now they've devised a new way of building and launching vessels

LAUNCHING a two-hundred-ton concrete vessel bottom up may sound fantastic, but it has recently been done with success by a shipbuilding company in Norway. The vessel was a reinforced concrete lighter (concrete strengthened by a skeleton of steel strips), and consisted of an inner hull of wood which served as a mould for the whole structure. When completed, there rested upon the launching ways the inner wooden mould, divided into watertight compartments, and the outer concrete hull, both bottom up. An inner compartment was left open at the bottom, so that water entered as the vessel left the ways, the air escaping through pipes in the hull. When this compartment was completely flooded, the water then reached the level of the two upper side compartments, causing the boat to lose its buoyancy and submerge to a position of unstable equilibrium. In this position, a slight list to one side caused the boat to heel over completely and float to a normal position.



Though launched bottom side up, and with a wooden form inside, the big boat slid smoothly into the water



Position A shows the boat just entering the water, the wooden form inside, and all of its watertight compartments full of air. In position B—water has entered the center compartment and also those along the bottom, the air escaping through vents. At C—the two lowest compartments, closed to the water, are buoying up on the boat and causing it to turn over. Drawings D and E show further stages. The water is afterward pumped out

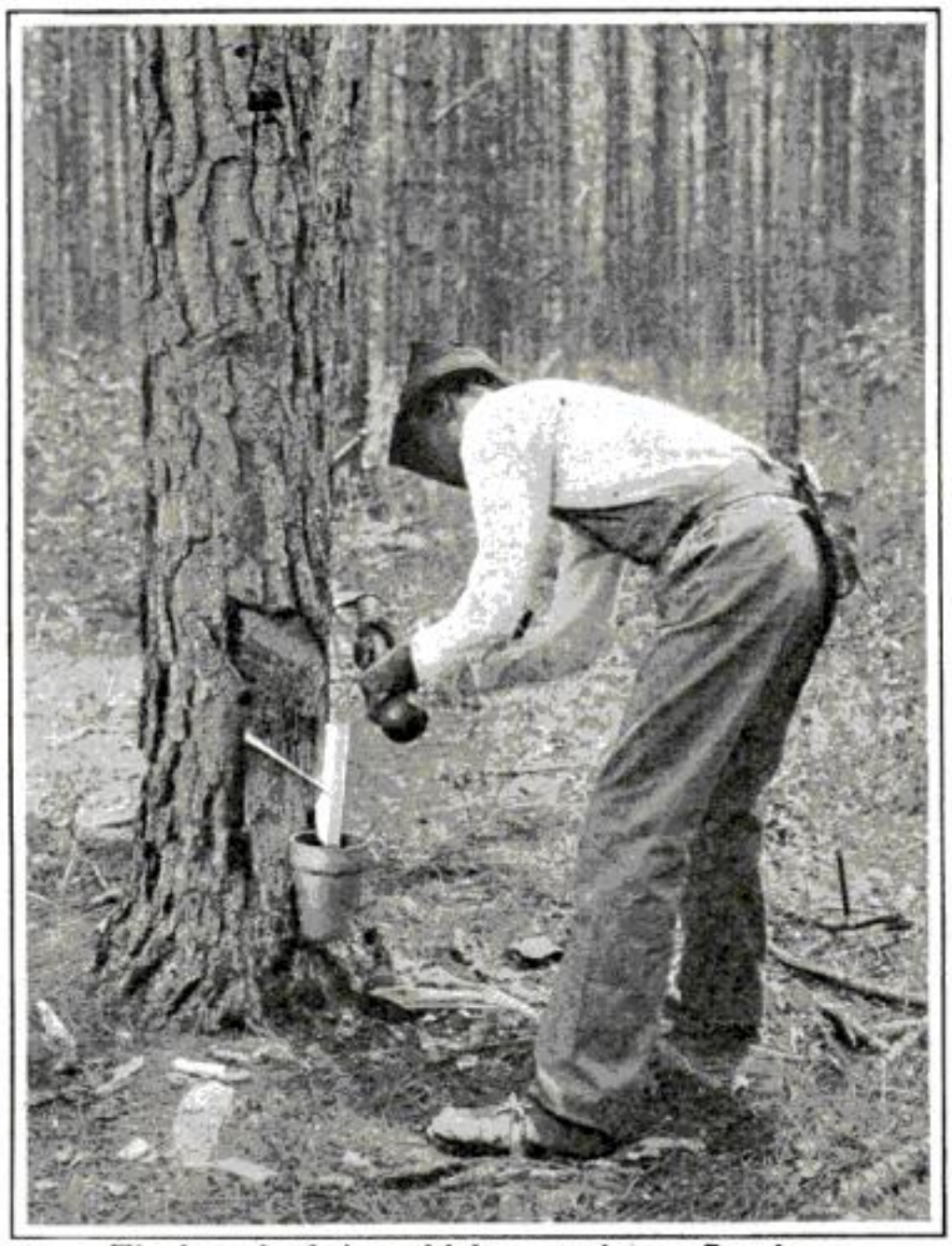
Varnish and Varnishing

Strange gums and oils and how they are made into protective coatings

By H. M. Beattie

VARNISHES are of two kinds. Spirit varnishes are made by dissolving a gum, such as shellac, in alcohol, but oil varnishes, in which class are most of the varnishes we know commercially, are made by cooking resinous gums in oil, and adding thinners, such as turpentine, or a petroleum product.

The character of the varnish depends on the qualities and properties of the raw materials used. Much gum and little oil produce the hard, high gloss, rubbing-varnishes used on pianos and furniture. Varnishes which must be more elastic and tougher, but which are not exposed to the weather, contain a less proportion of gum to oil, while the exterior varnishes of all kinds contain the greatest quantity of oil and are known as "long-oil" varnishes. Varnish which is used on a railway coach must have elastic qualities, and must be able to withstand the elements better than the varnish used on a chair, or on the interior trim of a house. The varnish that is used on tables and interior trim must be able to withstand more blows and rough treatment than the carriage varnish. The varnish maker has spent many years in developing a particular varnish for each particular purpose, and while he makes a universal varnish adaptable to almost any need, experience has shown that for the best work, a particular varnish manufactured for a particular purpose always gives more lasting satisfaction.



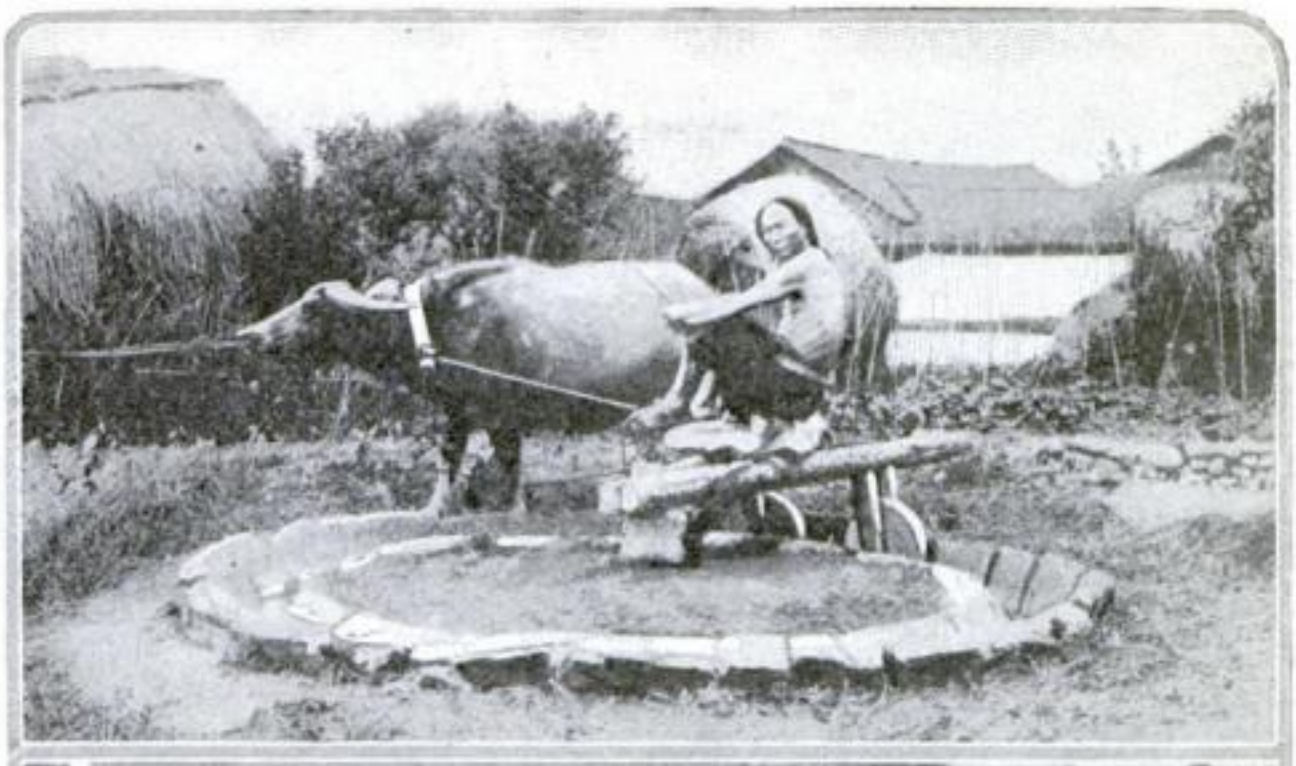
The long-leaf pine which grows in our Southern States produces both turpentine and resin

Varnish Making Begins in New Zealand

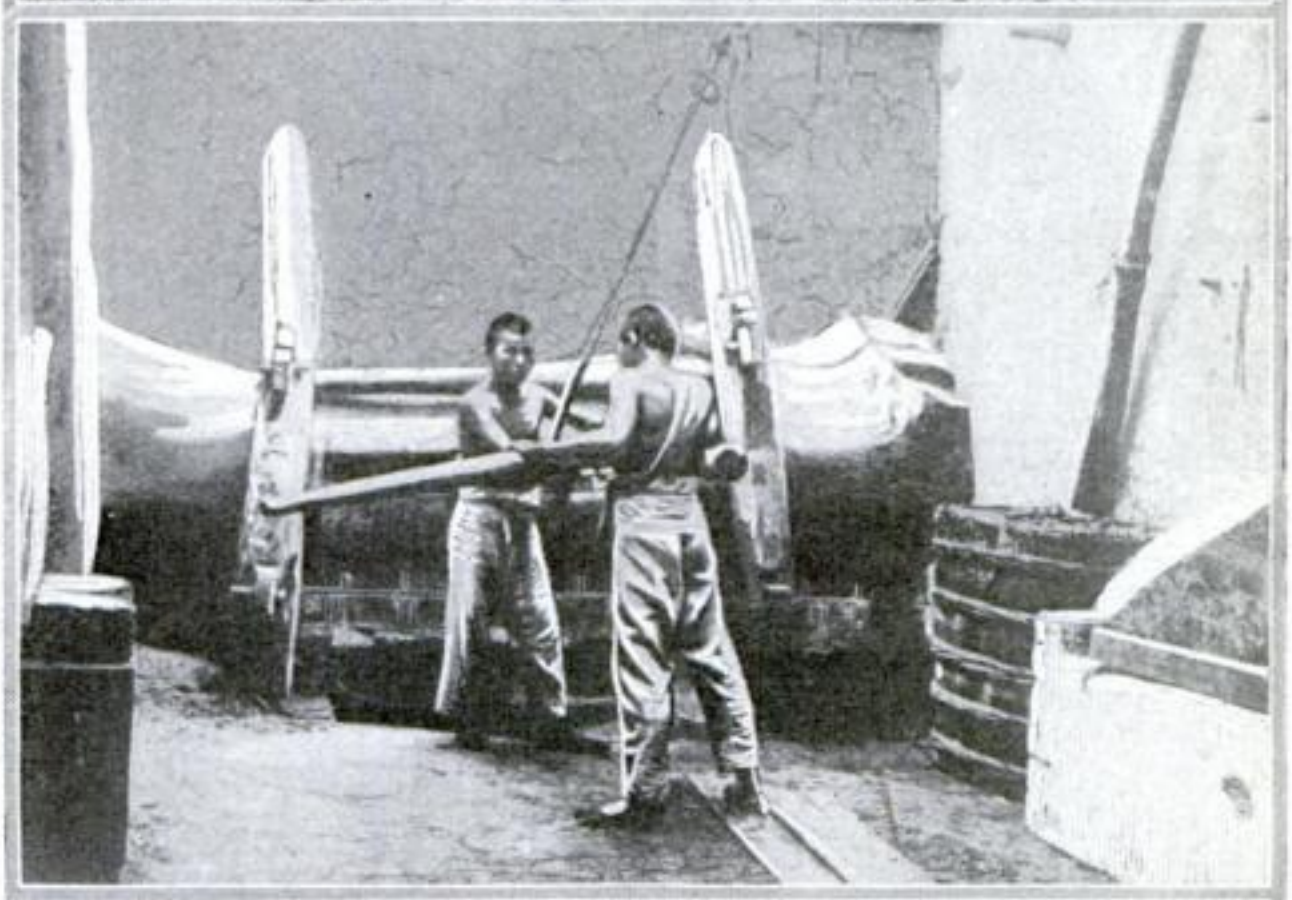
The gums used in varnish come mostly from New Zealand and from Africa. The gum from New Zealand is called kauri gum and is the best known. It is a semi-fossil resin that has been buried in the ground, many hundreds of years. It is sought for in primitive ways. Armed with a long iron rod, the native prospector explores the ground sometimes to a depth of six feet. He can tell by touch when he strikes gum. He then digs up the piece, which may weigh a few ounces or many pounds. He sorts this gum and sells it to the foreign middleman who in turn deals with the varnish maker. The kauri gum is a harder, tougher gum than the African gum and commands a higher price.

The oil most used in the manufacture of varnish is linseed oil. Linseed oil is obtained from flaxseed. Flaxseed has

Varnish Making Begins in New Zealand



This Chinaman's grandpa did it this way, and grandpa's grandpa and all the rest. It's a family custom, don't you know? "Tung" nuts are being ground down in the trough. They give a valuable oil, useful in varnish and finishes



Pressing the "tung" nuts. The apparatus is crude and ages old. The meat of "tung" nuts is much like that of Brazil nuts. The oil obtained gives a more waterproof finish than does linseed oil. Varnish makers buy it in large quantities

This little jungle maid has been out prospecting for kauri gum. She thrusts her long, iron rod in the ground and tells by touch when it has located a lump

Kauri gum passing from the native New Zealander to the exporter. The material is a semi-fossil resin found underground where it has lain for hundreds of years. A lump may weigh a few ounces or several pounds

been grown in the northwestern States, in Canada and in India for many years. A new and important source of supply is Argentina, in South America. The flaxseed is crushed and then heated to a temperature of about 160 degrees. It is pressed in large hydraulic-presses and yields from 26% to 34% of linseed oil. This oil is settled or filtered, and then treated chemically to remove certain mucilaginous matter, called "foots," before it is ready for the varnish maker.

China Contributes a Wonderful Oil

China wood-oil is another large factor in varnish making. It is the product of the "Tung nut," a nut growing in China. The nut has a soft shell and a meat similar in appearance to the Brazil nut. The shells are removed, then the nuts are crushed, heated and pressed in the most primitive way to produce the oil which is shipped to this country for varnish making. The oil has peculiar waterproof qualities not common to linseed oil.

Turpentine is the product of the long-leaf pine tree, grown in the Southern States of this country. The sap of this tree is collected and distilled. The distillation produces turpentine and resin. Resin is also used in the manufacture of the cheaper varnishes and after it has undergone certain treatment it becomes fit for use in varnishes of better quality.

All of the raw materials are brought together in the varnish factory and carefully tested and graded for purity, color and other characteristics.

How the Varnish Is Made

The varnish itself is made by melting a quantity of gum in a covered copper or aluminum kettle, over a fire. Coke is the fuel usually employed. The varnish maker knows when the gum is sufficiently melted, by the way it runs off the end of his stirring rod. The kettle is removed from the fire, and the oil, which may or may not have been previously heated, is added to the melted gum. The cover is removed and the kettle returned to the fire. The mixture is then cooked at a determined temperature until it has a certain viscosity or "body." The kettle is cooled down to a temperature at which it is safe to add the thinners. The next step is the aging of the varnish. Certain varnishes attain their perfect condition only after long months of standing in tanks, where a slow blending-process goes on. This aging gives to the varnish properties that make it last. The varnish has to pass rigid tests for "body" or viscosity, for color, and for drying quality also brushing and flowing tests before it is ready for the market.

Varnish kettles. A coke fire heats them. The gum is melted, then oil is added

Varnish makers experiment many years to get better mixtures. This is a brush test

The Ball-Bearing Creeper

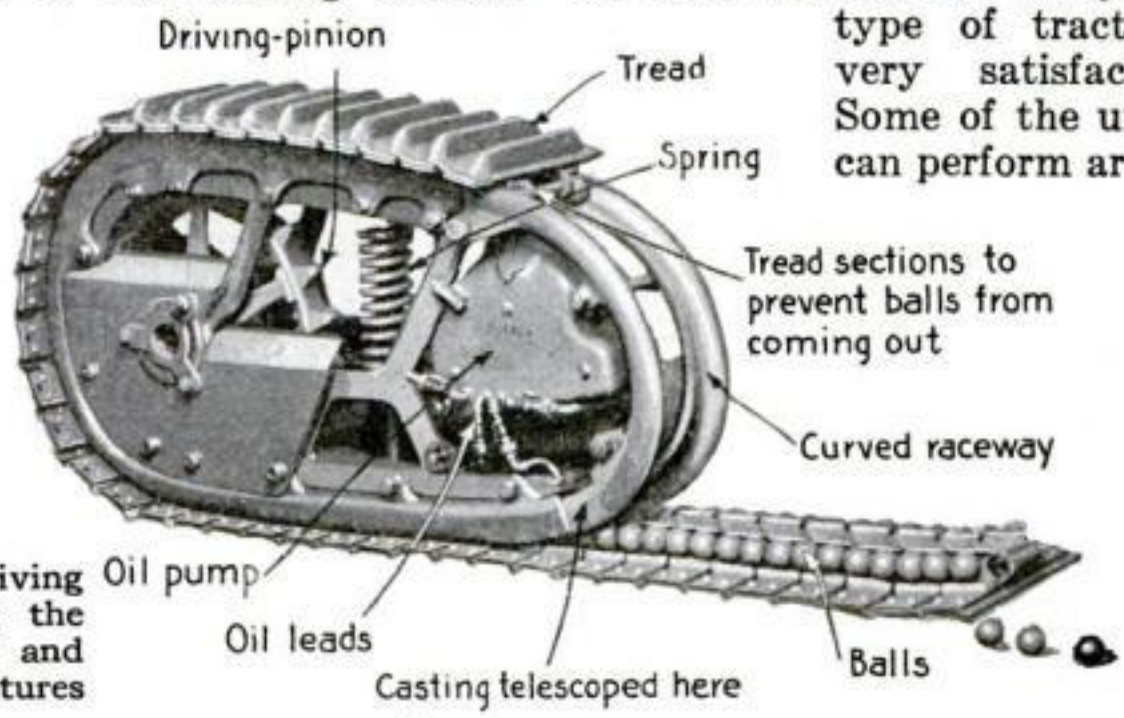
It coasts down plowed ground and crawls along hillsides because of its easy-running qualities

Ploughed ground is as nothing to this tractor

ANOTHER step forward has been taken in the reduction of friction and therefore of loss of power, in farm tractors, by means of the introduction of ball-bearing creeper or track-laying units.

The use of ball-bearings in creeper units has two great advantages. The first is the saving in power effected by the reduction in friction, as a result of which saving, more of the vehicle-power can be employed for doing useful work in pulling plows or other equipment, instead of being consumed in merely moving the tractor itself. That follows from a test which was made by the University of California and in which a ball-bearing tractor actually coasted down plowed ground with a three per cent grade.

The second advantage is that the tractor may work on side-hills without clogging or binding the treads. This is due to the semi-spherical shape of the two, joining raceways and the slight circular motion which they permit. In levee or side-hill vineyard work, this type of tractor has given very satisfactory results. Some of the unusual feats it can perform are shown in the illustrations. Each of the driving units is controlled by separate clutches, so that the tractor can be turned about in its own length.



At right: A driving unit, showing the ball bearings, and structural features

Never mind a little thing like a mud bath. Walk right in, turn around, and walk right out again

We Are Making Our Own Indigo Now

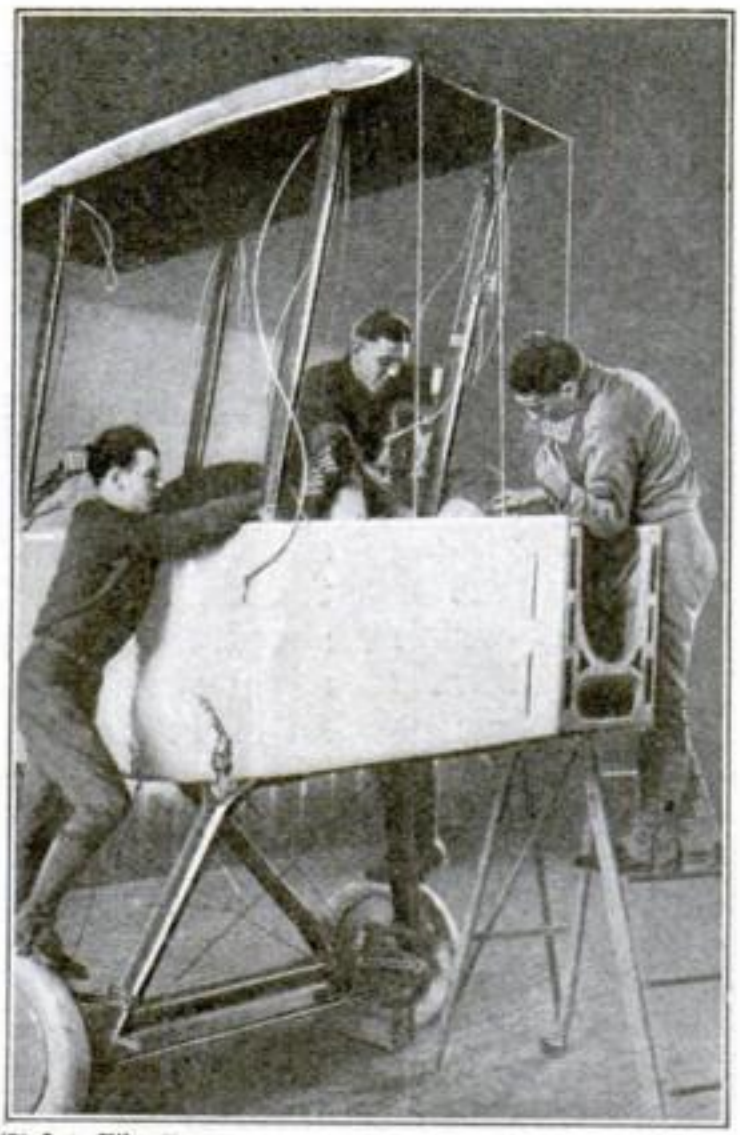
INDIGO is now being made from coal-tar in this country. At Midland, Michigan, one thousand pounds of twenty per cent paste are produced daily. All the tariff bills of this nation, commencing with the tariff of March 3, 1883, and including the tariff of October 3, 1913, placed indigo on the free list. Not until September 9, 1916, was a bill passed putting a duty on it. It was the first schedule that braved the anger of the German dye makers.

Tuning Airplane Wires

Ever notice how a tuning fork vibrates when you strike the corresponding note on a piano? Airplane wires are tuned on that principle now

ONE of the most common troubles on all airplanes has been the difficulty of correctly adjusting the tension of the wires used for bracing the wings. Some of the wires may be tauter than others, after a few hours' flying. There has been no ready means of correcting this fault. In consequence, great stresses have been thrown on some of the wires, while others suffered hardly any tension at all.

In tightening wires, mechanics rely entirely on their touch and hearing. They twang the wire with their fingers as they would the string of a guitar, listen to the note emitted and judge the tautness accordingly. The error average on the part of a skilled mechanic—after his own work had been tested with scientific instruments—was found to be about 30%.

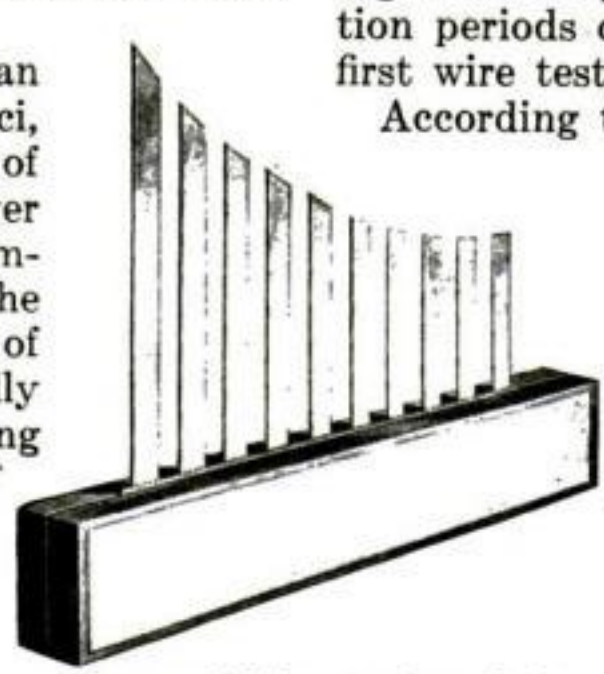


© Int. Film Serv.

Airplane wires must all be at the same tension. Here a new multiple tuning fork determines pitch, hence tightness, and fitness for flying

It remained for an Italian aviation officer, Carlo Lerici, to hit upon a practical way of helping the mechanic over his difficulty. The accompanying illustration shows the simplicity and ingenuity of his device, which is really nothing but a multiple tuning fork.

A block of wood holds a series of metallic tongues, resembling those of a mouthorgan. The length of these tongues determines the musical note which they give off when struck, and this, of course, depends upon the number of times they vibrate in a second. Tuning forks vibrate in sympathy with strings of corresponding notes. A "G" tuning fork, for example, will vibrate sympathetically when held close to a piano on which the note "G" is struck. Similarly, when an airplane wire is twanged by a mechanic, and the Lerici "vibrometer" is held close to its end, one of the metallic tongues on the instrument will vibrate in sympathy. The mechanic has only to take note of the vibrating tongue and read the number of vibrations per second, written below it on the wooden base. He then takes the instrument successively to the other wires and "tunes" them by tightening or loosening them respectively, until their vibration periods correspond with that of the first wire tested.



The multiple tuning fork consists of reeds clamped in a block. Each end vibrates at a certain known pitch

According to the inventor, the chance of safety is increased fully 15% by making all wires equally taut. A series of tongues with 20-40 vibrations per second is sufficient for all the modern airplanes used in the war.

The same principle is currently used in determining the frequency at which electric generators are operating. Reed-meters are among the simplest existing.

A Metal Bottle-Cover That Never Wears Out

A METAL bottle-cover to take the place of the unsanitary paper cover has been devised by Harry W. Spangler, of Allentown, Pa. It may be used over and over again on any number of bottles. It fits around the neck of the bottle like the paper cover, but instead of being pried off, it is turned from right to left by means of a knife, held in the hand of the operator.

The knife is placed between three projecting points on the surface of the cover, these points forming a kind of groove. The cover may be used on fruit jars as well as on milk bottles or other glass containers, which need such a protection.

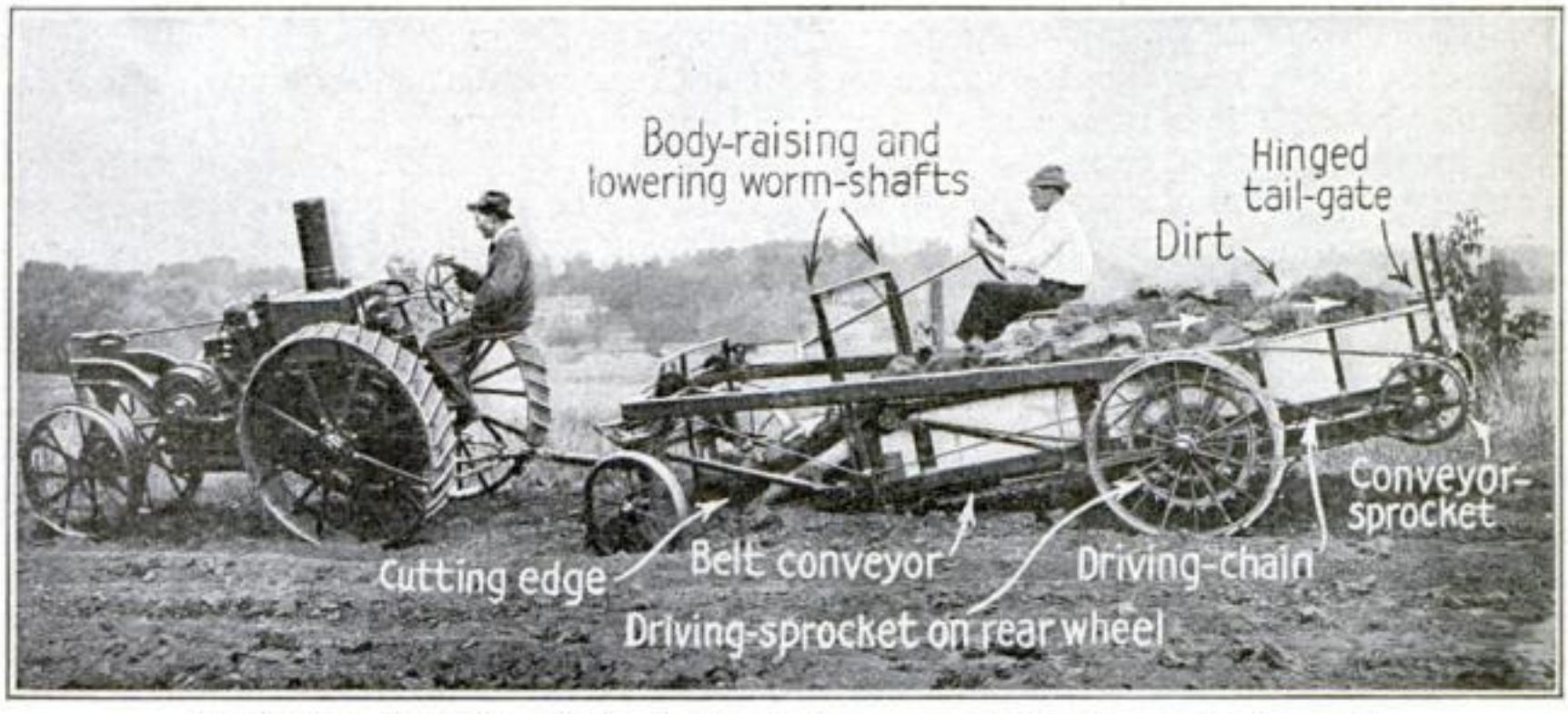
To remove the cover, a knife is placed between the points and turned

This New Self-Loading Wagon Makes Road Grading Easy

THE new device shown in the accompanying illustration, is designed to load and unload road-grading dirt three times as fast as any other similar type of machine. It consists of a light four-wheeled trailer, with a body pivoted about the rear axle. The bottom of the body is an endless belt, automatically driven as the trailer is pulled along by either a four-horse team or a light tractor.

The body is lowered at the front end to the desired angle by means of a worm gearing under the control of the operator on the trailer, who also controls a cutting edge much like that of a plowshare, located in front of the forward end of the conveyer belt. This cutting edge scrapes up the dirt and throws it back on to the forward part of the endless belt which carries it to the rear of the body and piles it up to the proper height until the entire body is loaded.

When this is done, the front end of the body is elevated to clear the ground. Then the trailer is hauled to the dumping place.



By tipping the body of the trailer to the rear, the load may be dumped all in one place or spread out in a thin layer by means of a hinged tail-gate

What Is Mean Sea Level?

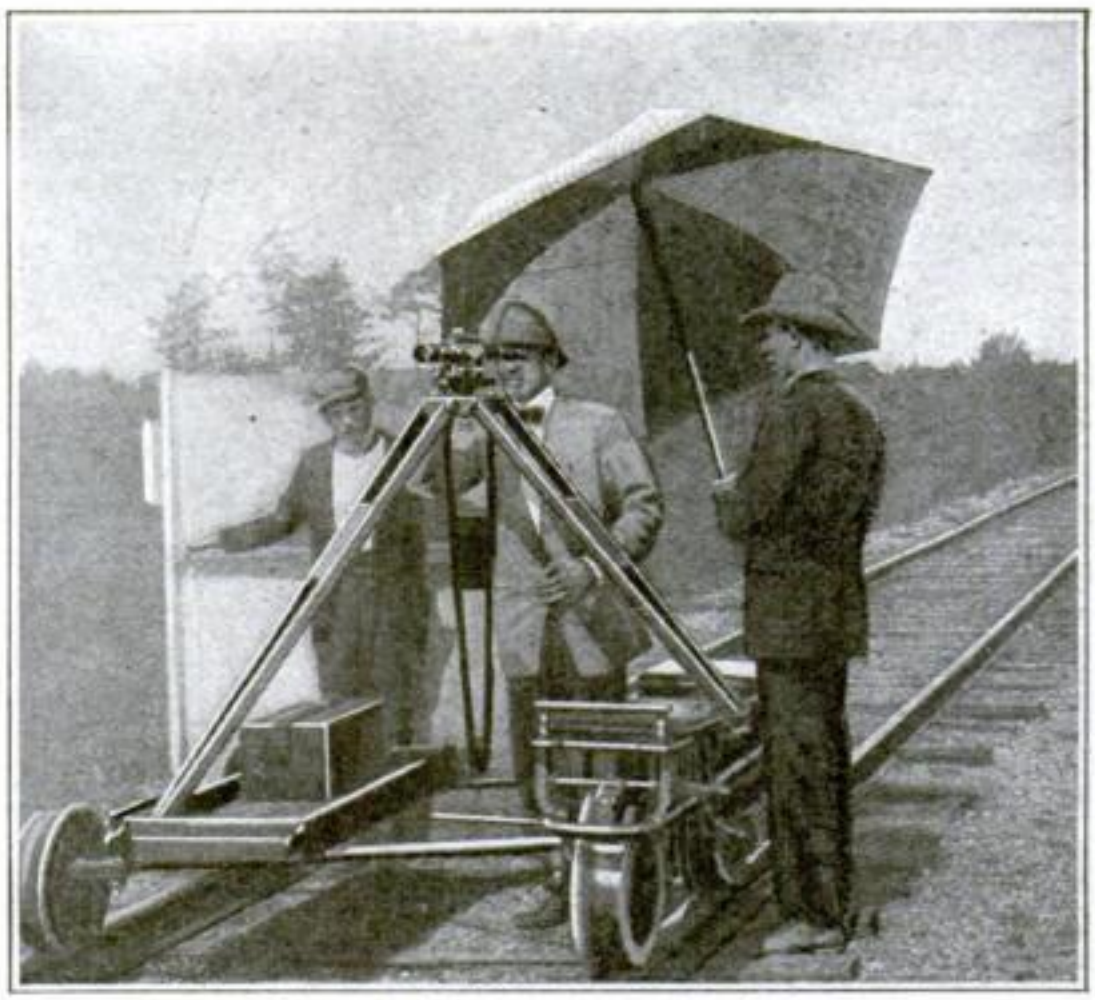
If there were no disturbing influences the ocean would be of one equilibrium

By William Bowie

Chief of the Division of Geodesy, U. S. Coast and Geodetic Survey

WHEN one speaks of the elevation of a place, he has in mind the vertical distance above an imaginary surface. The surface is generally that of the oceans imagined to extend inland under the point considered.

If there were no disturbing influence by the sun and moon, the force of the winds and the varying pressure of the air, then the surface of the oceans at all places would be one of equilibrium. If lines of precise leveling were extended inland from the Atlantic, Gulf and Pacific assumed to be quiet to Chicago, for instance, and if the leveling were done absolutely without error, the elevations of their junction points would be absolutely the same for each line.

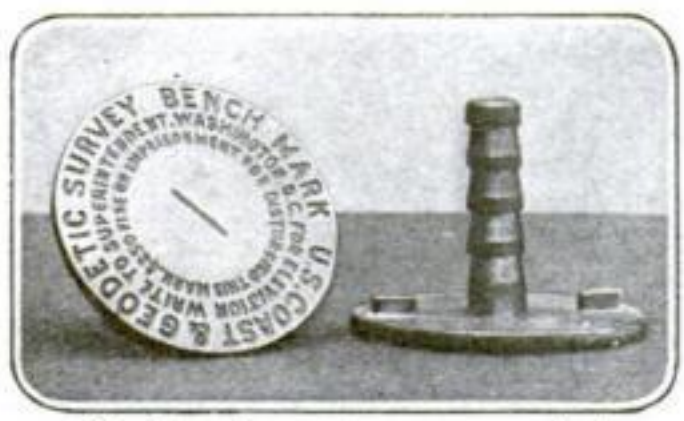


How the Observations Are Taken

The leveling is done along the railroads because of easy transportation. The engineers ride on motor velocipedes. Note the sunshade and windbrake. The leveling instrument, which was designed by an official of the U. S. Coast and Geodetic Survey, is considered the most satisfactory one in the world. Its tripod is mounted on one of the motor cars. On the second car there is placed a listing adding-machine on which the observations are recorded. Wonderful speed is attained. A party working in Michigan in 1916 ran 340 single miles of levels in one month.

But the waters of the oceans are rising and falling in response to the forces acting on them, so in order to obtain an accurate starting point, a tidal station must be established, and the position of the water's surface with relation to a graduated staff must be observed each hour for at least a year. The average position of the surface of the water during the year will be almost exactly mean sea level.

Under the direction of Major E. Lester Jones, its superintendent, many such stations have been established along the coasts of the United States by the Coast and Geodetic Survey, and lines of accurate levels have been extended from them to furnish bench marks, which control the surveying, engineering and mapping done by the Federal Government, the States and cities and by private persons.



The bench marks are cemented into masonary or concrete

An elevation is the vertical distance above what would be the surface of the water if a sea-level canal were extended inland from the ocean to the bench mark.

Each line is run twice in opposite directions to guard against errors.

Between Stokes, He Knits for the Red Cross Unashamed

A BIG, burly, railway fireman has adopted knitting as his avocation. Between runs or even between shovels, Jack Ryder can be seen sitting in his cab placidly knitting away at a sock or a sweater for one of the boys "over there."

We see that he wears gloves while about his duties. Thus the article knitted is kept fresh and unsoiled.

This brave pioneer's example is being followed by other employees of the Burlington Road. So if your train is delayed, be sympathetic. Perhaps the fireman has dropped a stitch—back along the right-of-way somewhere.

Burlington fireman knits between times. Never a stitch does Jack Ryder drop

Wherein a Head and a Little Ingenuity Save Much Work

AN ice manufacturer of Hutchinson, Kansas, saves time and money in loading ice into refrigerator cars. He has built a kind of viaduct over two switch tracks, a street and across the roof of the Rock Island freight wharves.

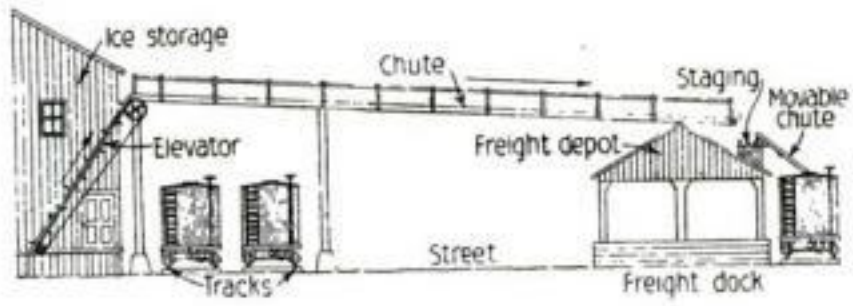
The viaduct is higher at one end, so that the two-hundred-pound cakes of ice, which are raised by means of an electric elevator, will slide by their own weight down to the car to be iced. At the lower end of the chute is a staging so that cakes coming down can be shunted to either side and dropped into different cars simultaneously. Formerly the ice was hauled on wagons and thrown in by hand.

Castor Oil Is Going Up

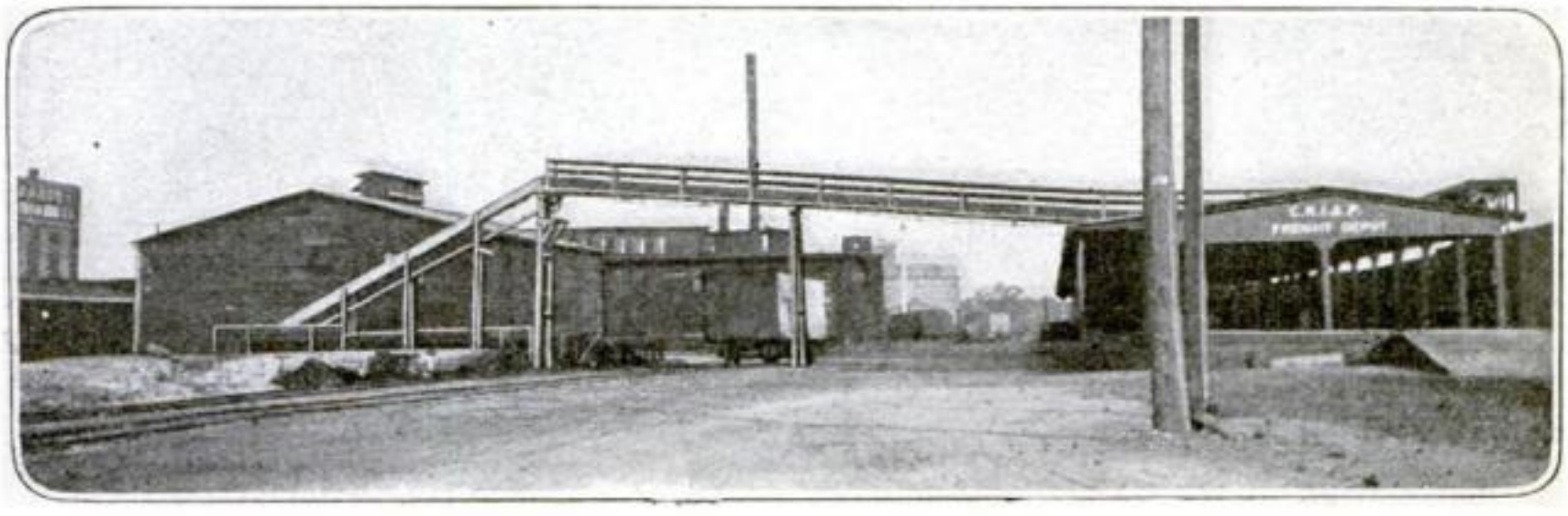
THE price of castor oil is advancing rapidly. No more children than usual have eaten forbidden goodies, but airplanes have developed insatiable appetites for this remedy.

The Government has recently been buying enormous quantities of this delectable article. So now the airplanes will get it for lubricating their engines.

At right: By utilizing a chain elevator and chute as shown, the ice maker saves much work

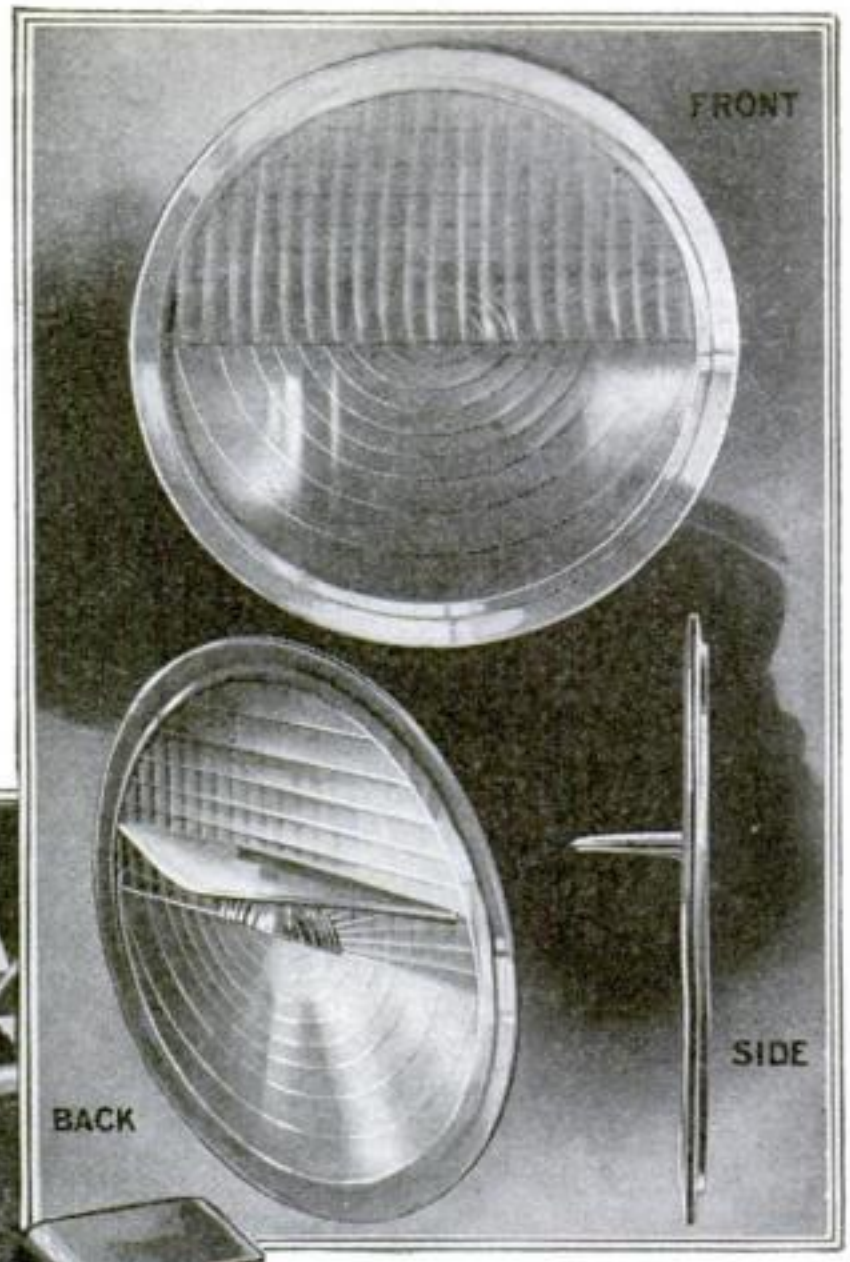


Below: The chute passes over two switch tracks, a street and the roof of a building

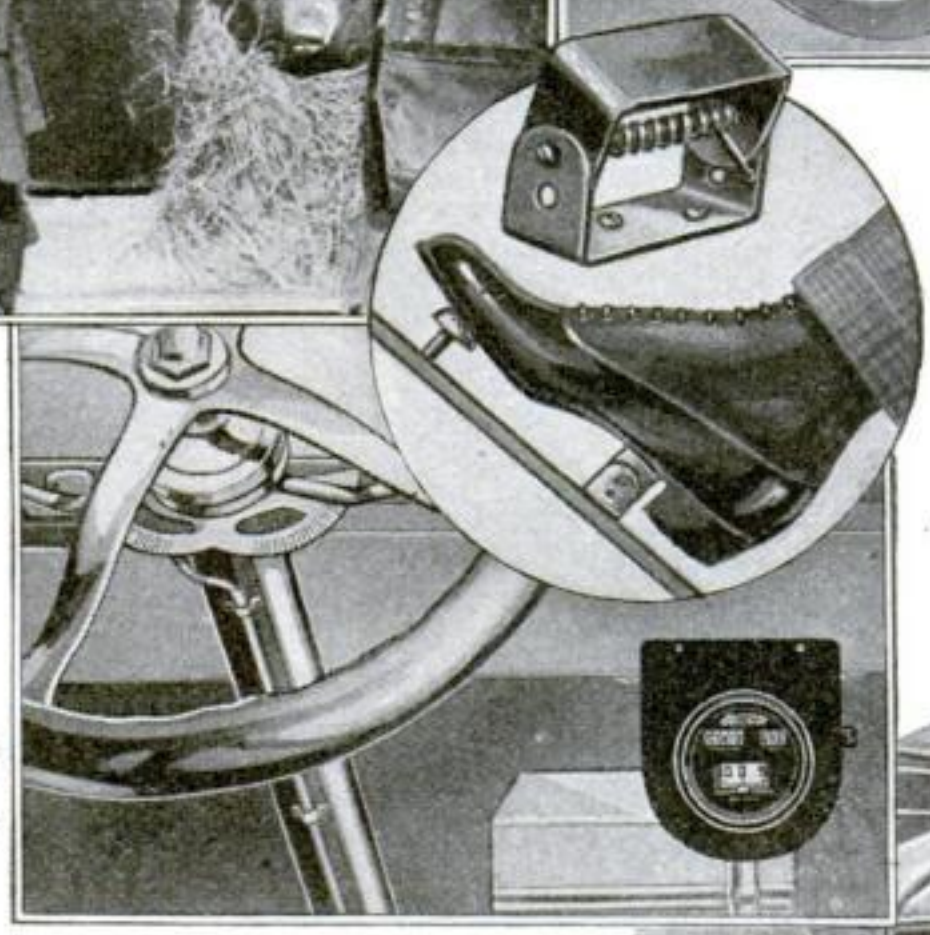


And Still They Come! Some Novel Uses, Comforts, Efficiency Devices, Conveniences and Economies for the Automobile and Motor Truck

Even the pig now rides to market in state, occupying the rear of the farmer's automobile



This new type of headlight dimmer has an inside glass shelf which catches and diverts the glaring light rays

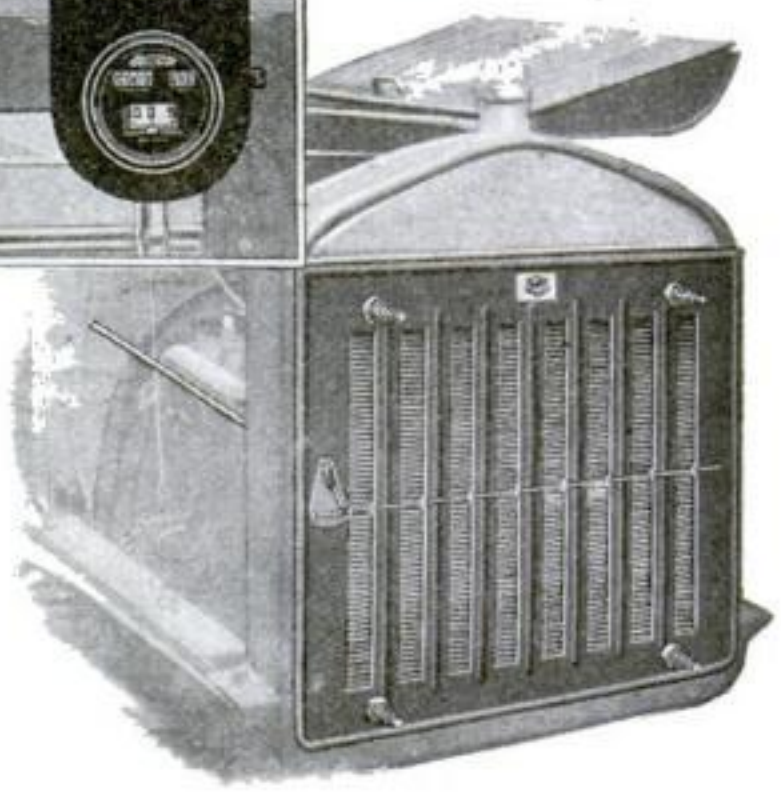


In circle: A rocking heel support for the foot that operates the accelerator

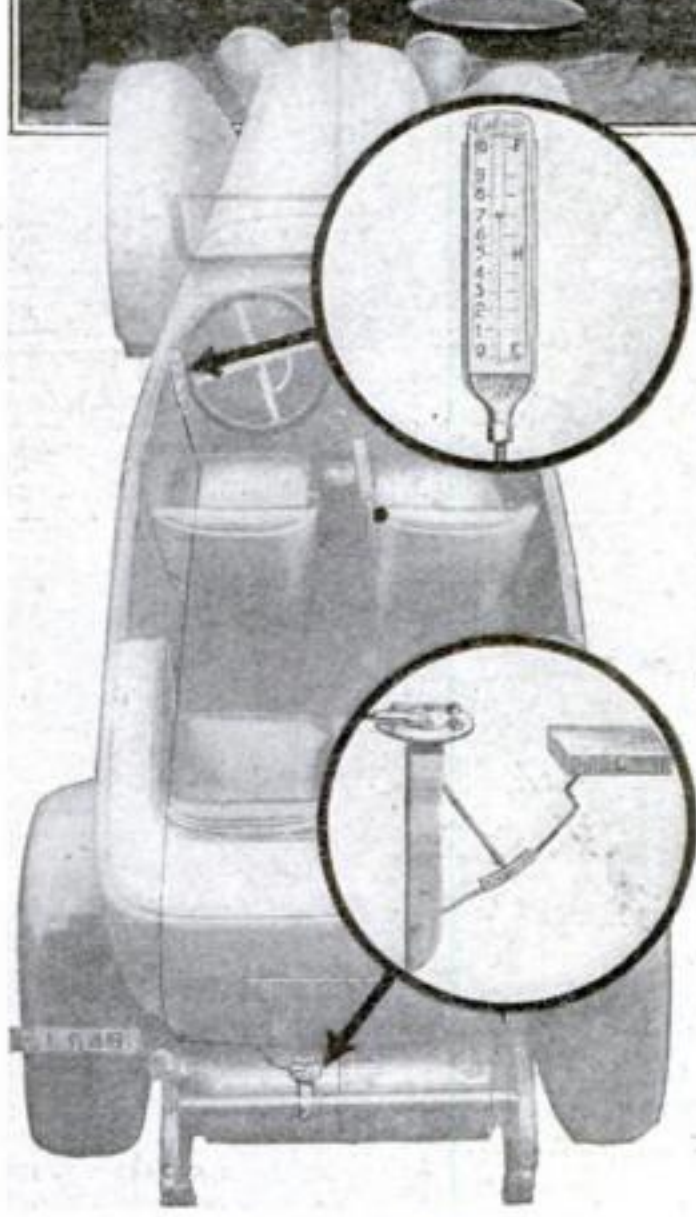
A convenient new speedometer. Two screws quickly attach it to any cowl

Each downward push of the cutter cleans the spark plug and polishes the wire points

A shutter which may be operated at will is held to the radiator with four small spring bolts



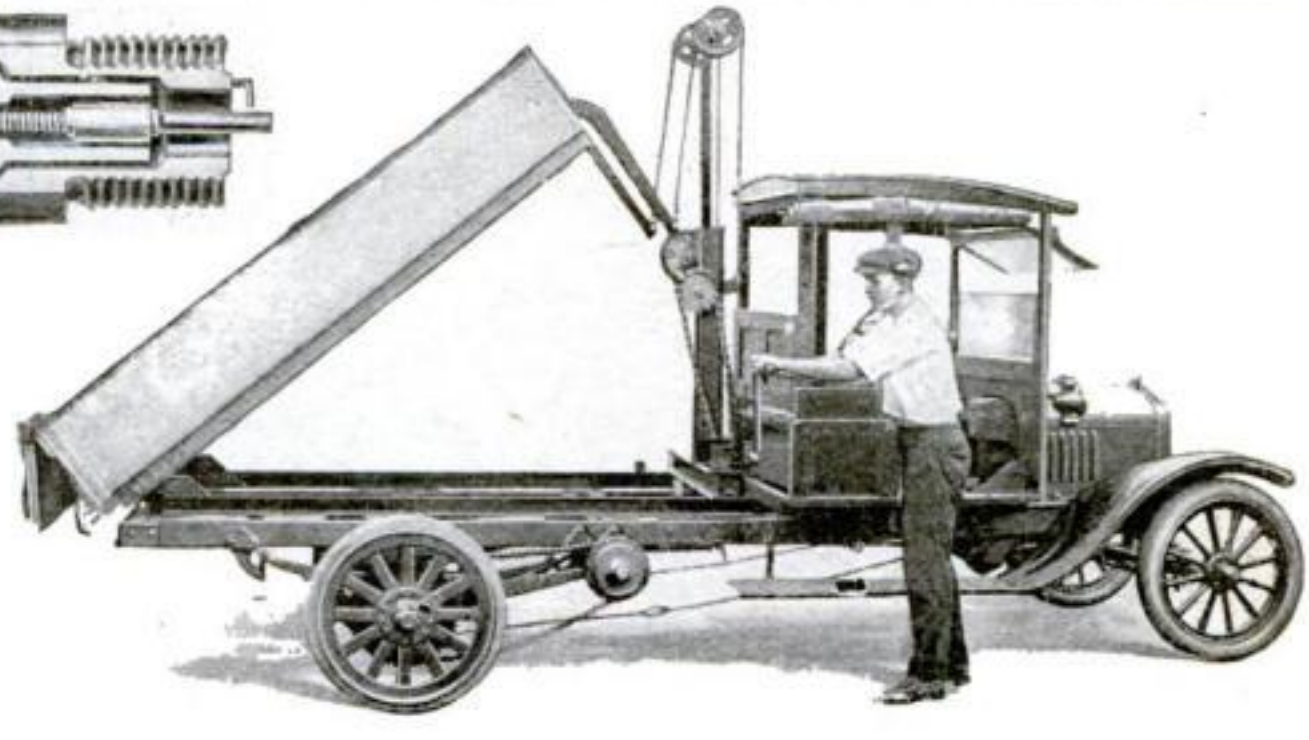
A powerful pumping engine of automobile construction



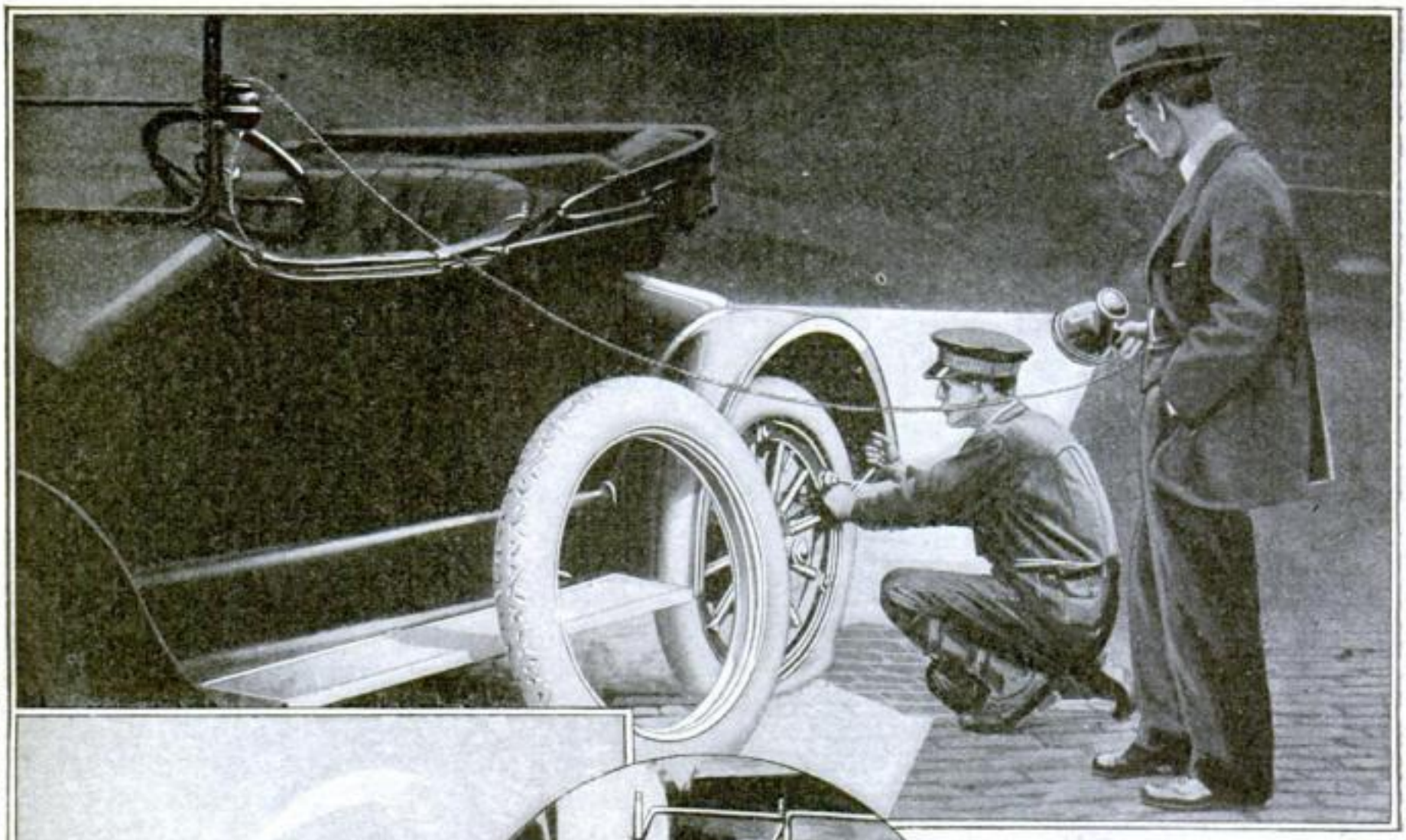
A float in the fuel tank connects a gage near the driver's seat which shows the number of gallons still in the tank

An inclosed socket for a flexible cord and trouble light which may be used on any part of the automobile that needs attention

A non-carbonizing spark plug that is supposed to burn off the carbon by its high working temperatures



A body hoist is shown to use in connection with passenger cars made from delivery trucks

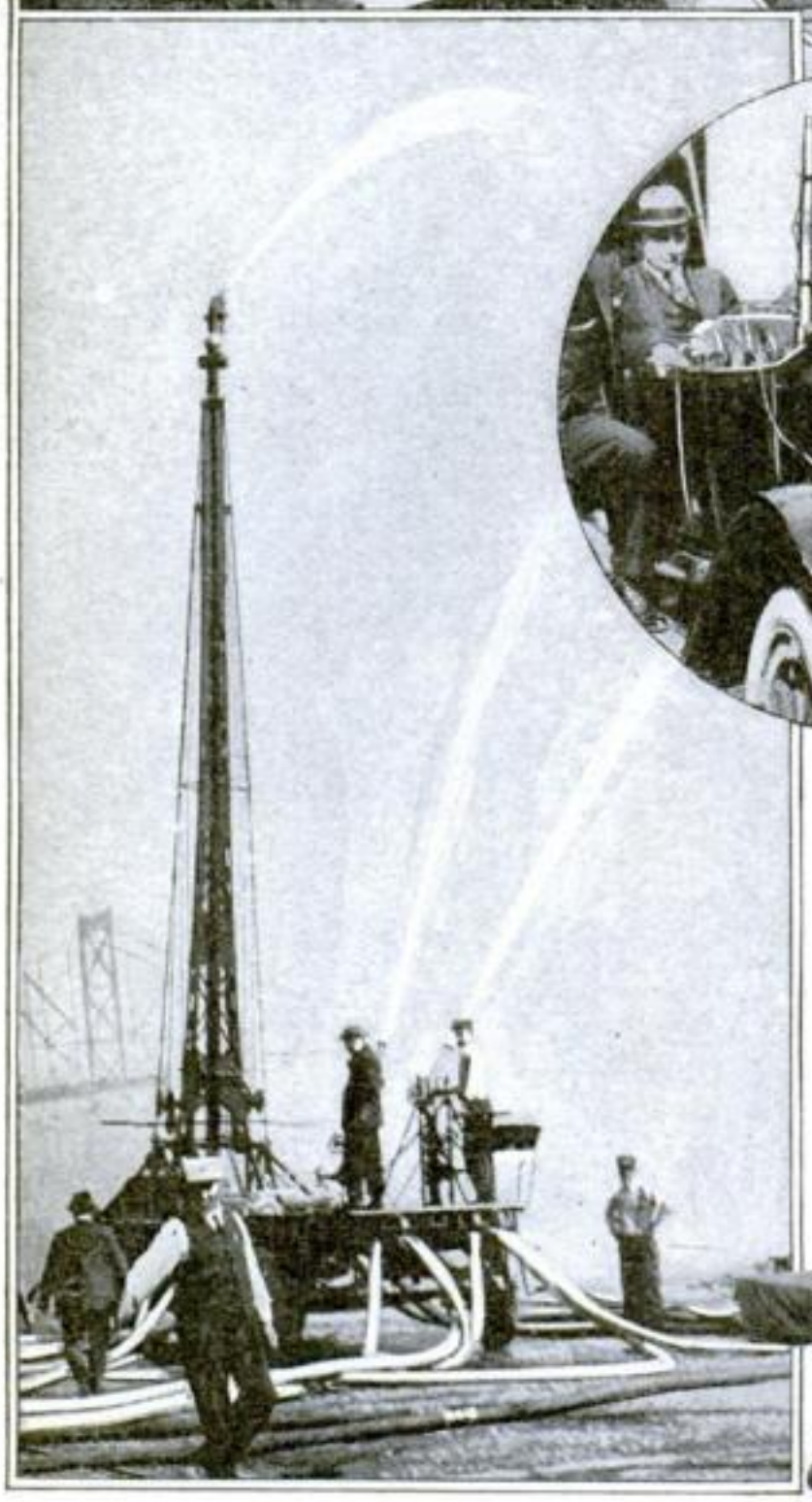


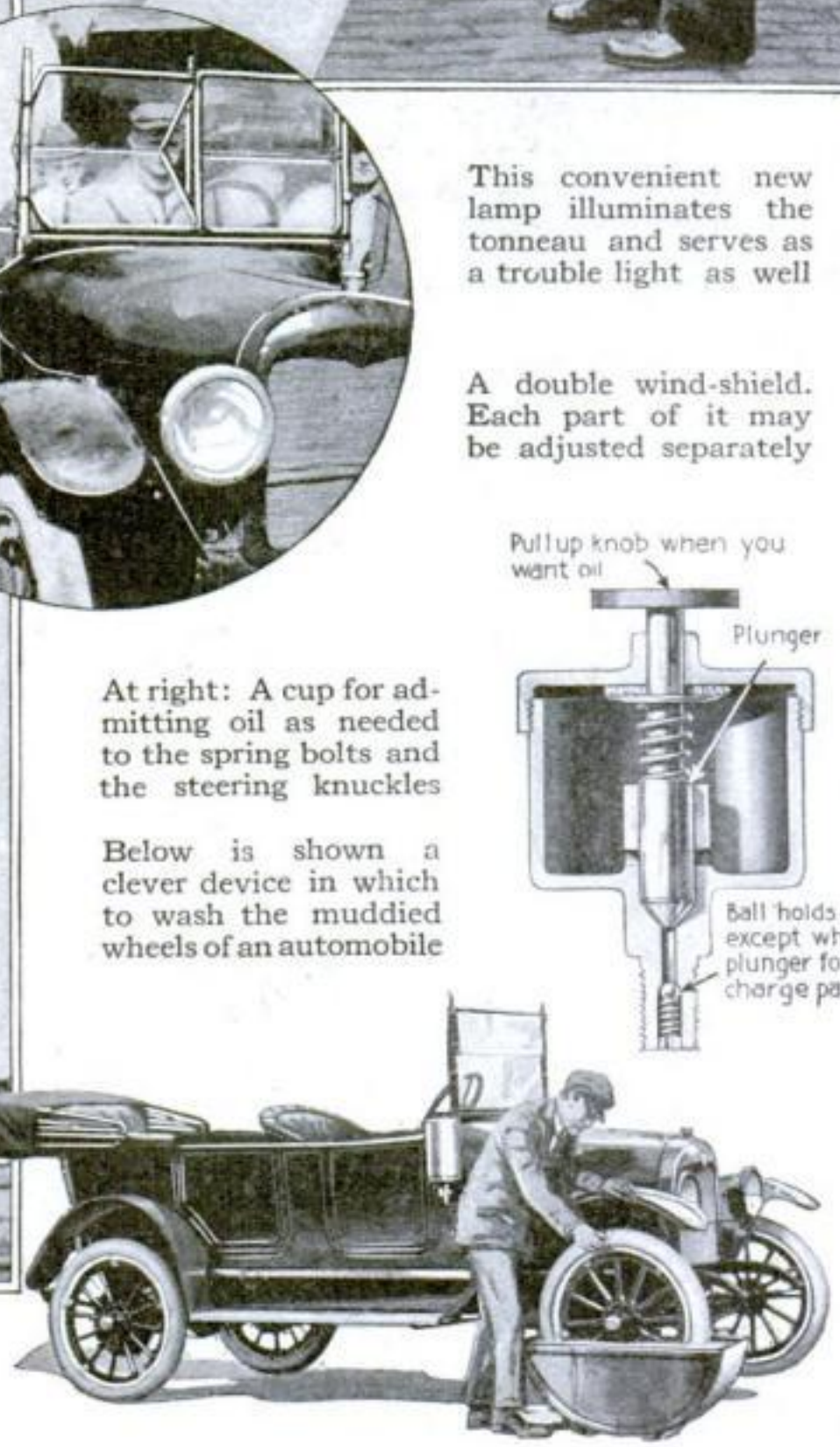
This convenient new lamp illuminates the tonneau and serves as a trouble light as well

A double wind-shield. Each part of it may be adjusted separately

At right: A cup for admitting oil as needed to the spring bolts and the steering knuckles

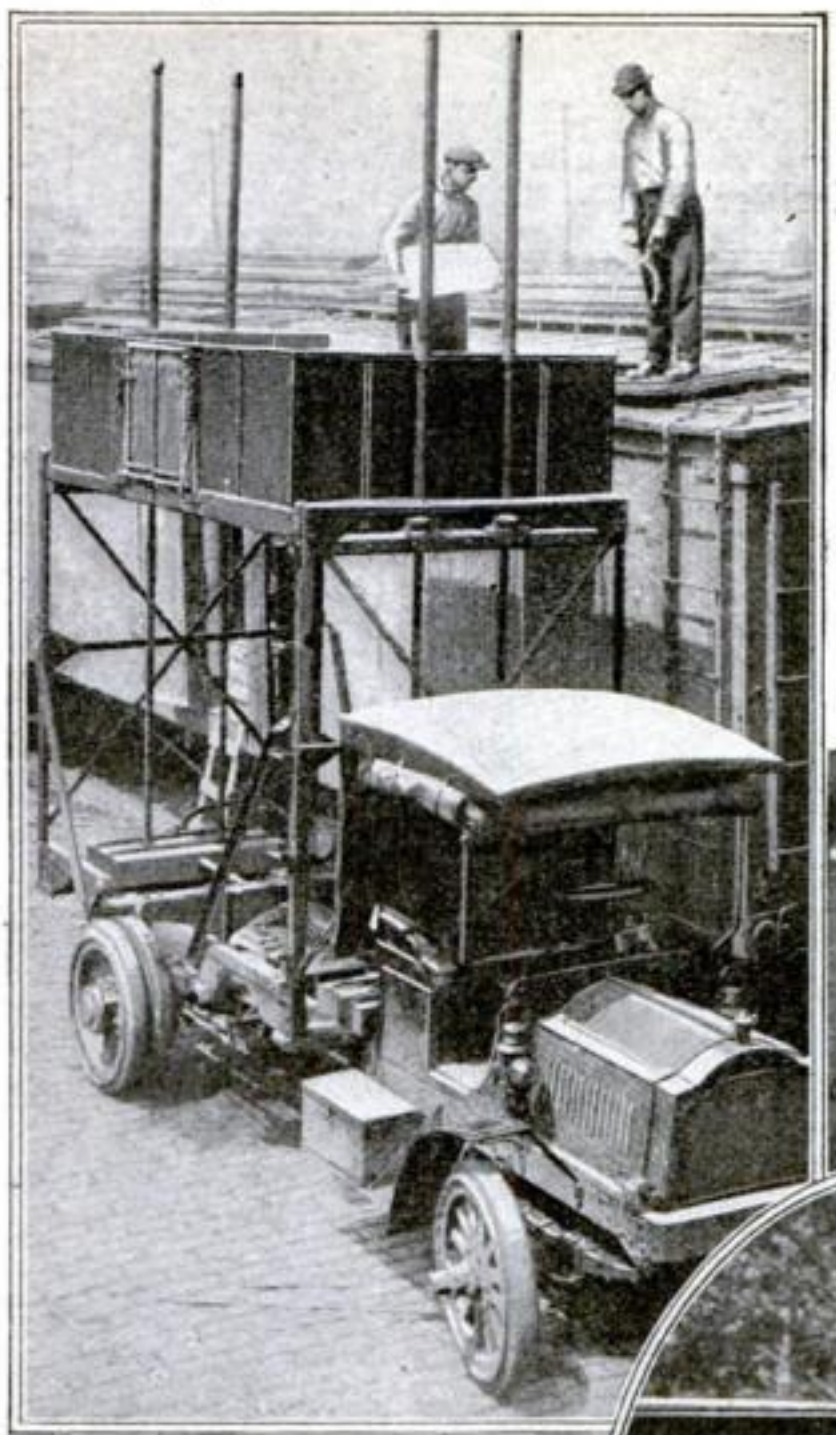
Below is shown a clever device in which to wash the muddied wheels of an automobile



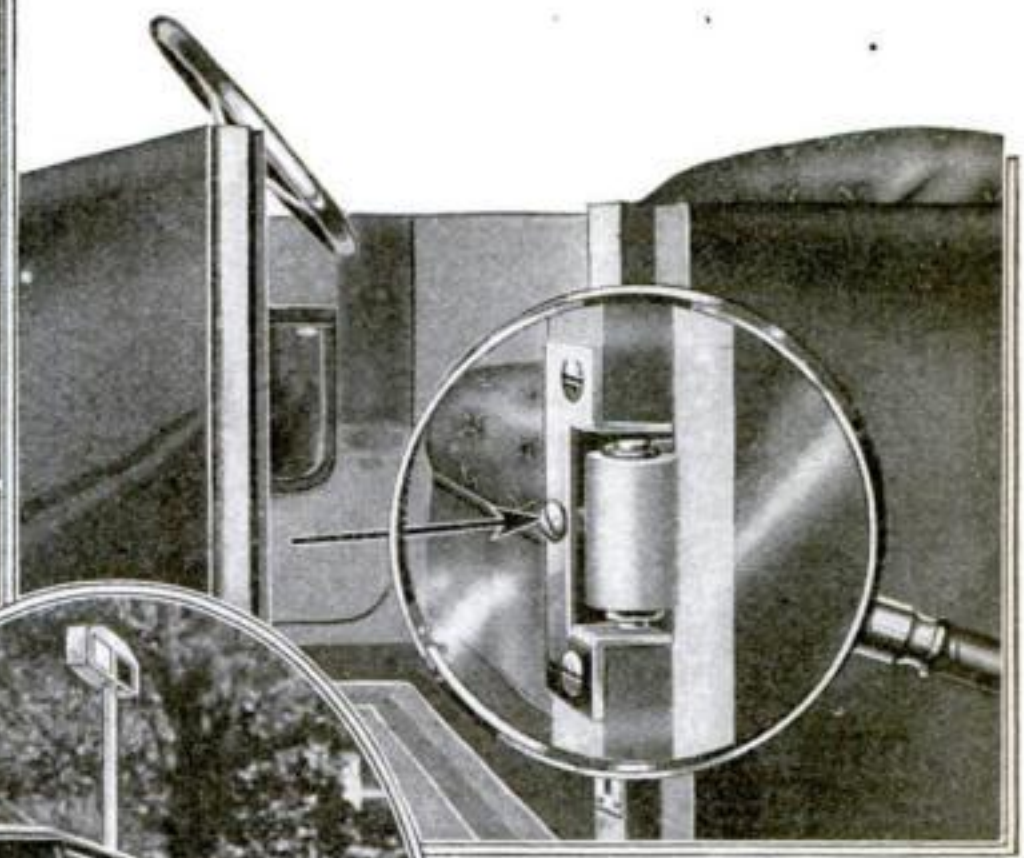


This motor fire-apparatus enables fire departments to cover a far larger area than was possible with old methods

Try These Devices to Make Your Automobile or Your Motor Truck More Efficient

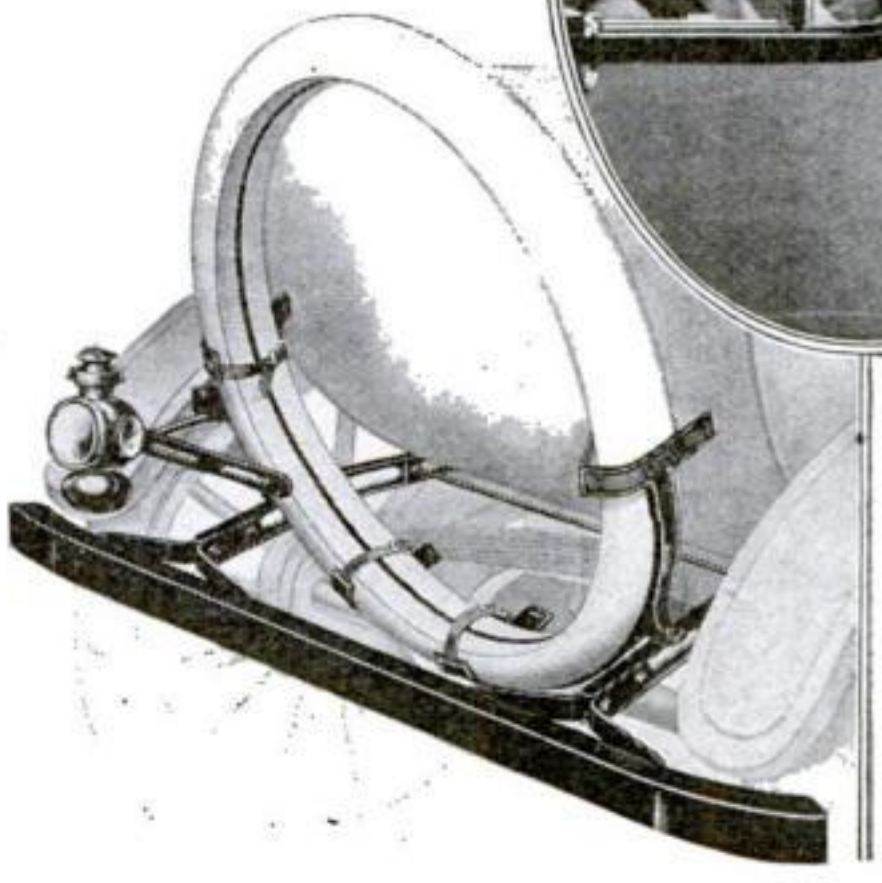


To unload ice more quickly, a body of the type used on coal carts is employed

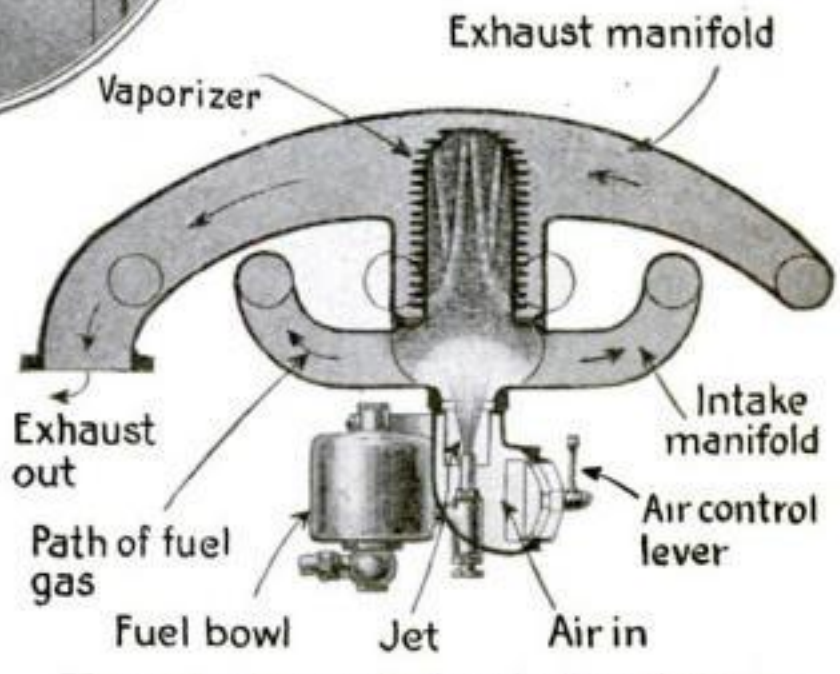


With this anti-rattler, the screw shown by the arrow adjusts the buffer to take up the wear

In the oval is shown a signal above the windshield which is used to locate a parked car



Combined tire guard and buffer quickly attached to the rear part of light cars



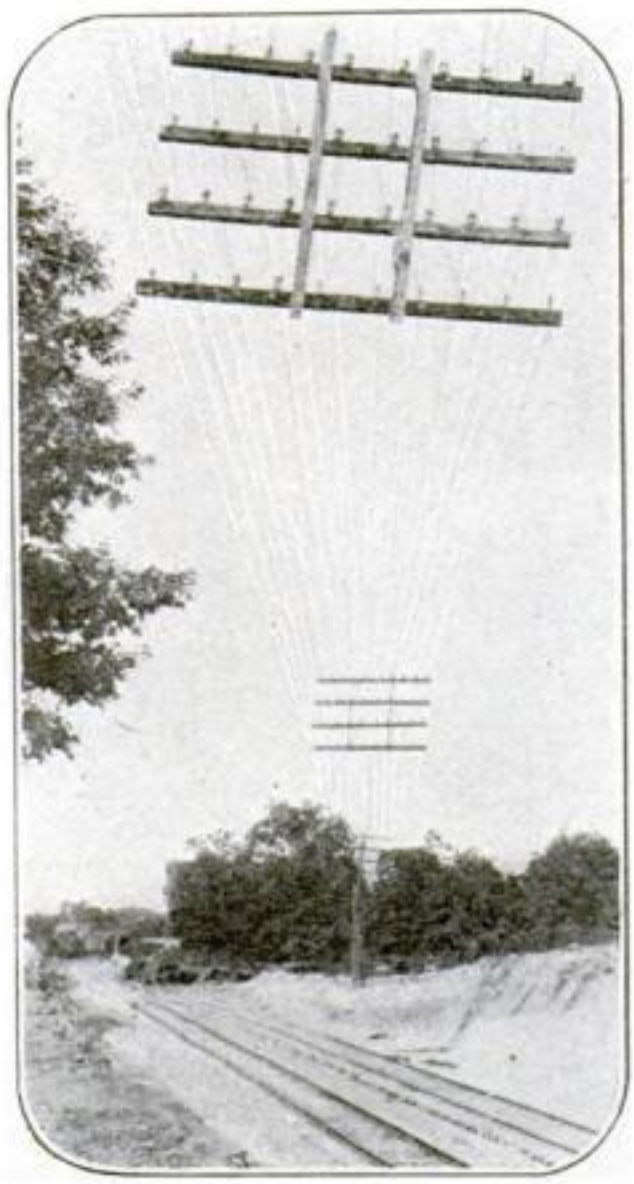
Heavy kerosene entering the finned chamber is there turned into burnable vapor

These Are the Trapeze Artists Among Telephone Poles

TELEPHONIC communication has become so much a part of our everyday life that the new camps springing up number telephones as among the first military necessities.

In equipping Camp Gordon, near Atlanta, Ga., the telephone wires had to be swung across a long, newly made railroad cut. Speed was imperative. Instead of making a detour, poleless, aerial cross-bars were placed in position, held secure by guy wires fastened to poles running at right angles to them.

Four hundred telephones will be installed. The plant needed to connect these telephones with the exchange is large enough to do credit to a fair-sized town.



Crossbars held in position by wires attached to poles at the right and left of the area shown in the illustration

How Would I Look in That Suit? This Device Tells You

PERHAPS you have seen a suit or a hat in a show window and have wondered how you would look if you were wearing it. Charles H. MacQuesten, of Bloomfield, New Jersey, has devised the means of gratifying your curiosity. His device consists of a support for a suit which is displayed in a show window at a height which would correspond with the height of the average man. Behind the clothes he has placed a mirror the lower edge of which is cut out to conform to the shape of the top of the coat displayed and of the beholder's chin. Thus the man looking in the window sees himself wearing the suit on display.

Trying on the suit in the shop window — the new way

Steel Wheels Are Becoming Popular

THE tendency to substitute steel for wood in the manufacture of wheels for automobiles and heavy trucks is not due to any desire to economize in the cost of the wheels, but is largely the result of the scarcity of good wood. In Europe, the wooden wheel has long been replaced by the steel wheel on trucks.

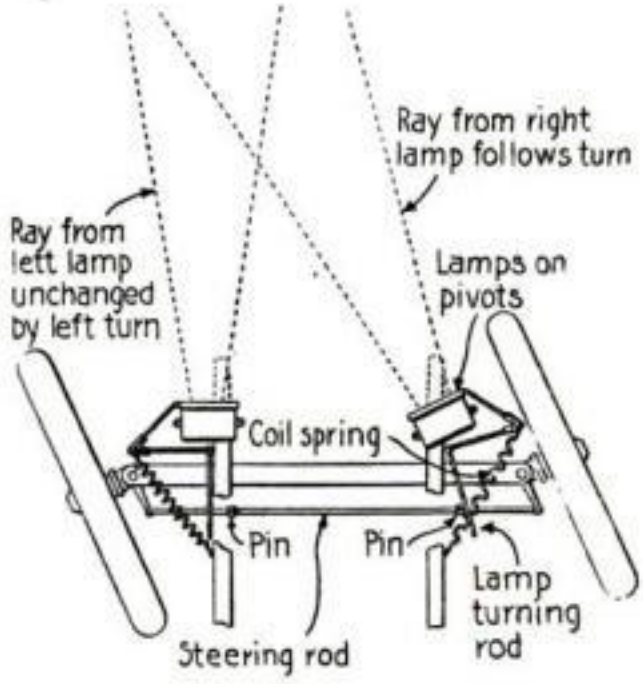
The most widely used wheel in England today is made from sheet steel. It is stamped in two parts. These are afterward welded together by an acetylene flame. The finished wheel looks almost exactly like a wooden wheel. There is an immense length of weld, however, which follows the mid-section of each spoke, so that this type of wheel is not considered a very good manufacturing proposition.

From three to six bolts are used, according to the size of the wheel. These have cap nuts. The outer nave plate is a loose fit on the hub, so that the wheel can be pulled off easily when the nuts are removed. The wheel can be supplied with a demountable rim if desired, but there is very slight demand for such rims in England.

Light Up Both Roads When Your Automobile Turns a Corner

BECAUSE an automobile in which he was riding one evening, went around corners so fast that it was dangerous, and because the front lamps were stationary and would not swing in the direction the car was going until it had turned completely, Frank E. Harvey of White Hall, Illinois, resolved that certain improvements in automobile headlights were necessary. Therefore, Frank E. produced a very simple and commendable invention.

The idea is to make at least one headlight turn, and that at the moment the steering wheel is revolved. Thus one headlight shines up in the new direction while the other continues to light the old roadway. In this way light is provided in the two places most needed when rounding a corner. The connecting rod between the front wheels supplies the motive power which moves the lamps. Two pins are made fast to this rod near each end, and the rod in its right-and-left movements causes one or the other of the pins to strike the arm of its bent rod leading up to the corresponding light. The illustrations show details. A spring keeps the parts taut and ready to respond to all impulses from the pins and rod.



One light points straight ahead, the other in direction car is going. Steering rod operates it

Below: Note how the light on left has turned with the wheels. Device prevents accidents

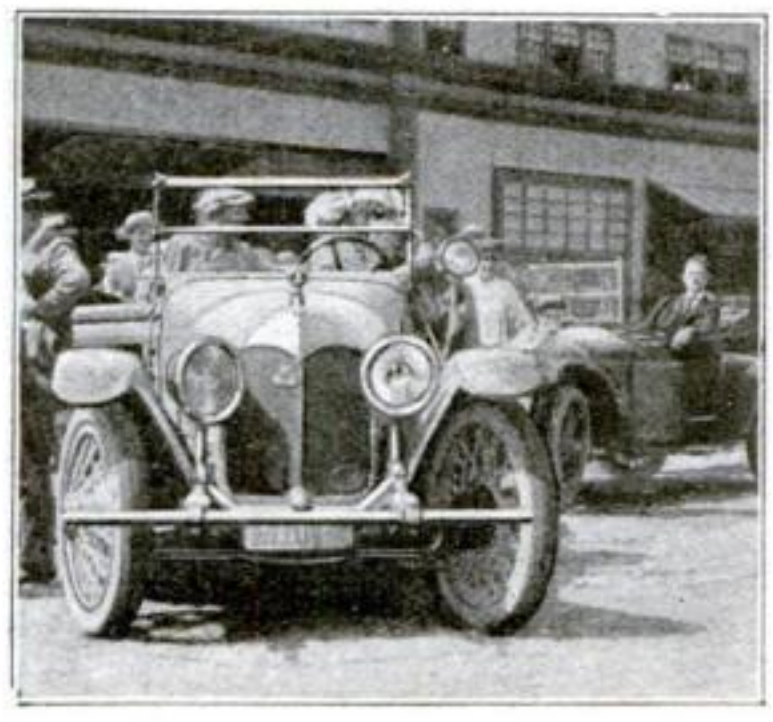
Two or three rolls will produce the warmest, brightest fire you ever kindled

Is Coal Scarce? Use the Newspaper Log.

THE only virtue no one has ever denied a newspaper, is that it burns well. But as fuel as well as in news, it has always been short-lived. Hence the newspaper log! It burns from three quarters of an hour to an hour and a half in any fireplace or stove.

Spread five sheets of newspaper, folded once, on a table, with the folded ends toward you. Begin to roll them into a tight roll. Before the first section is completely rolled, insert another section, and continue until the "log" is from two to three inches in diameter. Saturate each roll thoroughly with kerosene.

Mr. F. H. Albee of Hyde Park, Mass. is the inventor of this economy.



Night-Moths and Their Guiding Flames

Electric lights and gasoline flares
to help the night-flyers land in safety

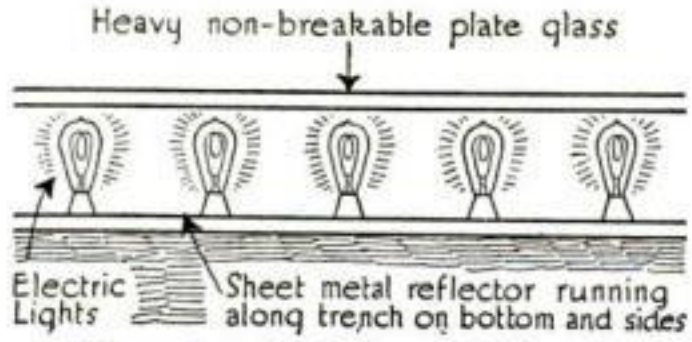
By Lieutenant Henry A. Bruno

Late of Imperial Royal Flying Corps, Canada

A NEST of the German machines that make frequent air raids on London when the weather is favorable was discovered by a solitary airman of the British Royal Flying Corps, who had been on coast patrol and, as often happens, lost his way in the darkness. From his report I write this description.

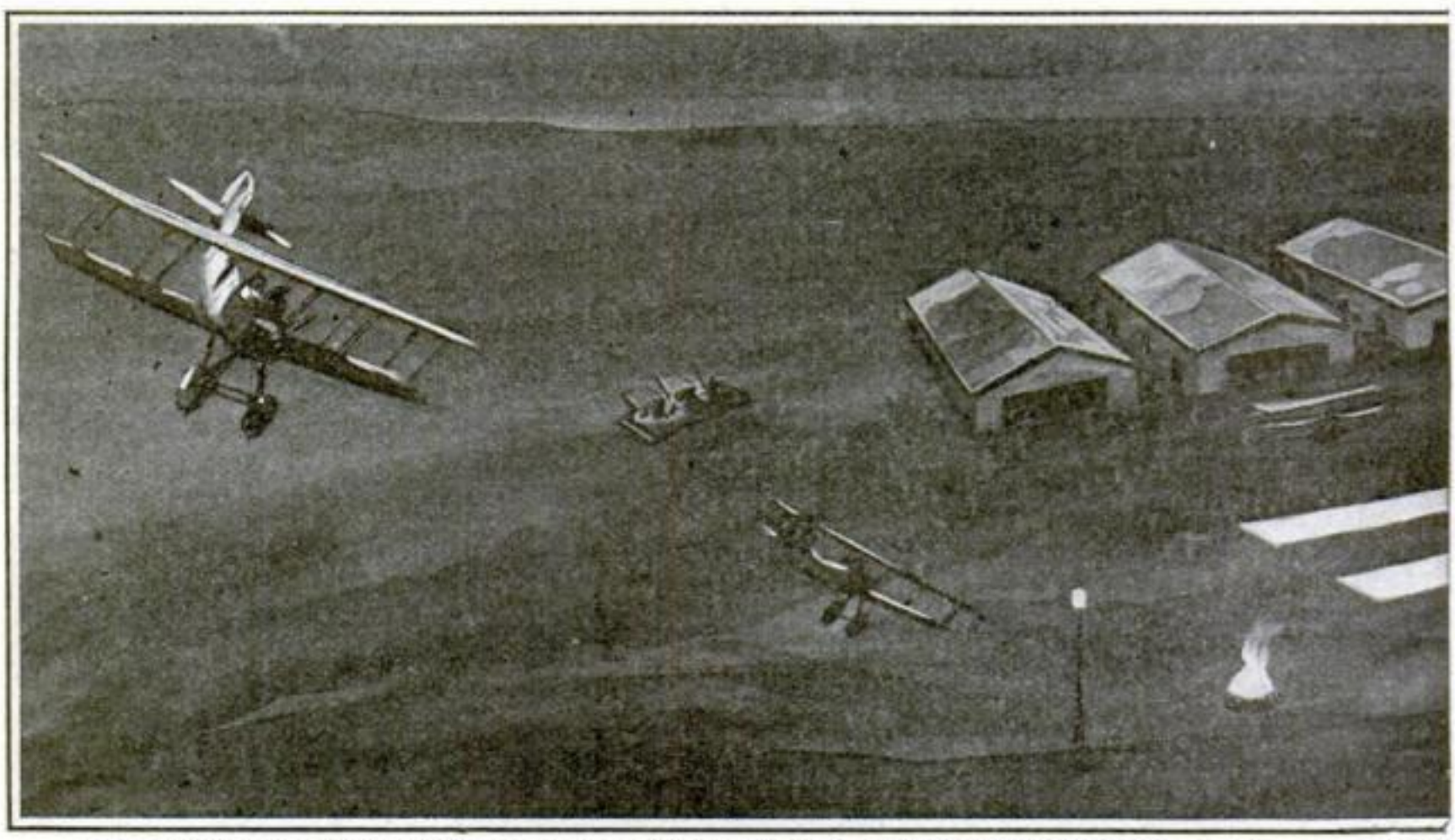
The aerodrome is protected by three anti-aircraft batteries, consisting probably of three guns each. There are five hangars, as the pictures show. How many planes they house is not known, but a rough guess places the number at about thirty. There are two large repair sheds at one end of the field, one of which contains a power house where electric current is generated.

In order that squadrons which fly at night might find their home again, the Germans left nothing to chance. They filled ten buckets with rope and rags, soaked in gasoline, and arranged them as follows: Seven in a line over a distance of seven hundred yards to form the long leg of the letter "L," and three more over a distance of four hundred yards for the short leg. Near the first bucket, at the beginning of the "L," they erected a pole twenty feet high, with a red electric light on top. When these gasoline flares, as they are called, are lighted, they can be seen from a great height on a clear night. The aeroplanes land toward the short leg of the "L," and run inside and down the long arm.

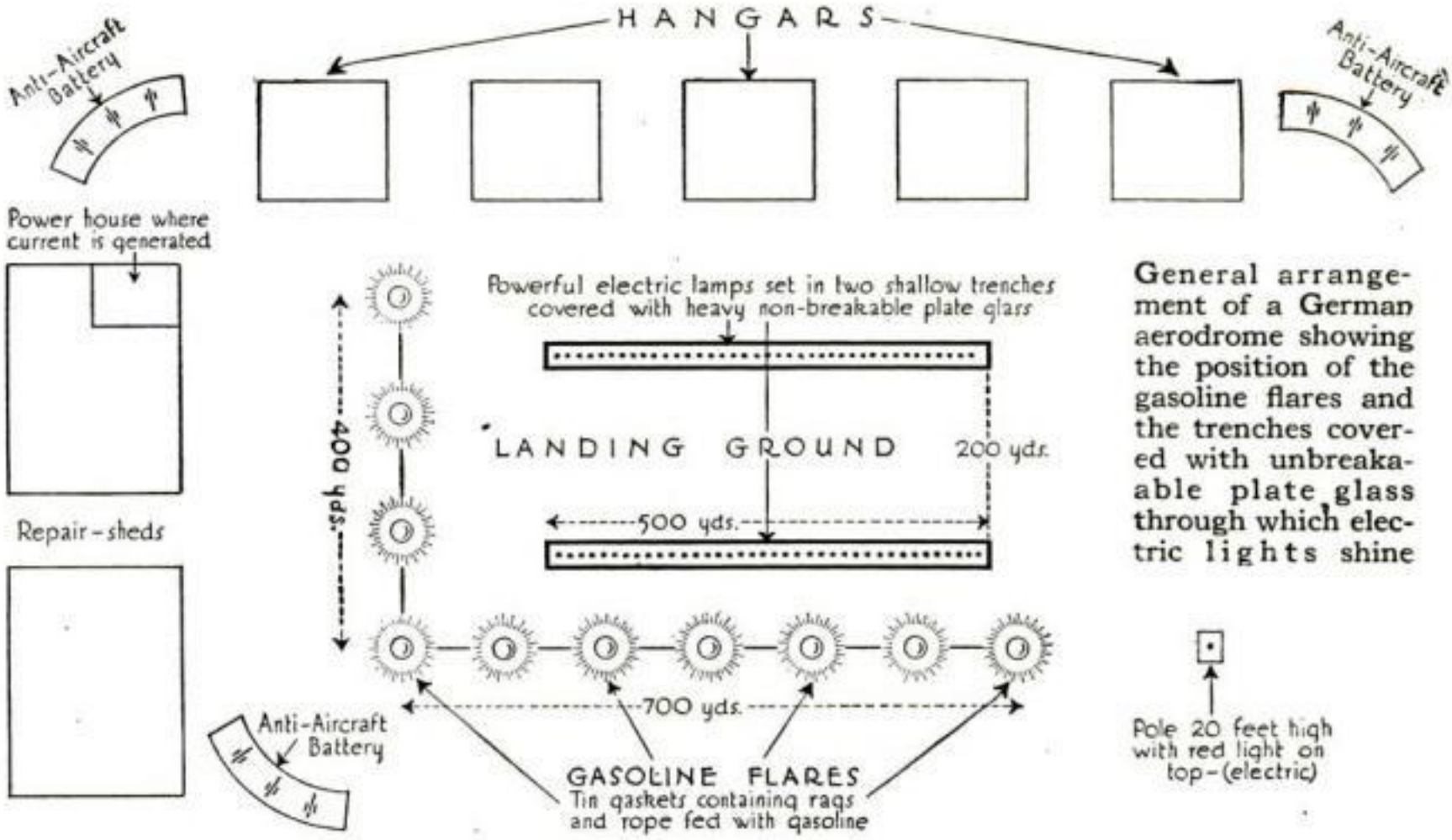


The electric lights within the trenches send up a bright glow

This system is also used by the Allies; but



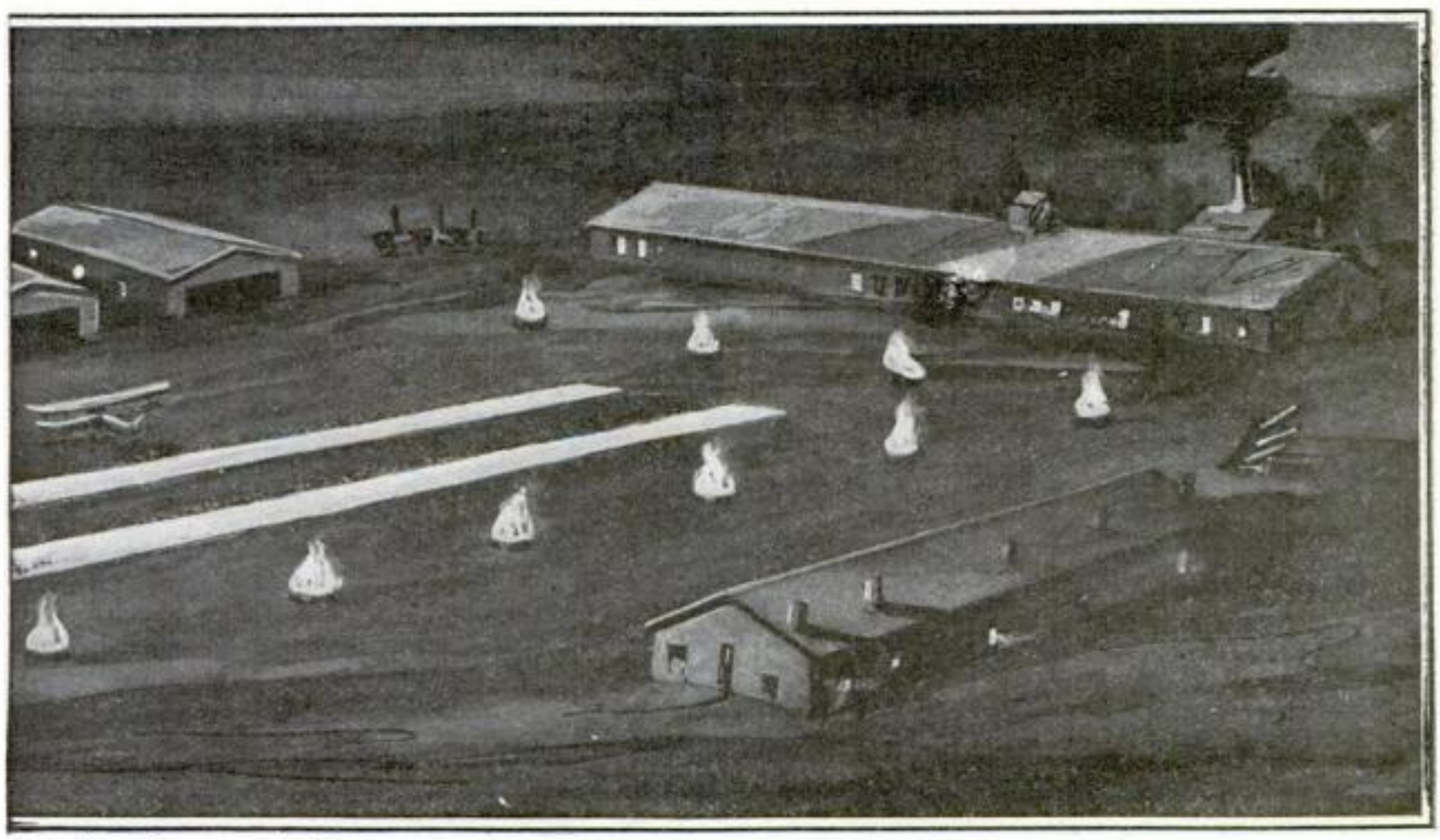
To assist their night flyers in making safe landings, the Germans have developed an ingenious system of illumination for their aerodromes. Within two line parallel trenches, electric lights



General arrangement of a German aerodrome showing the position of the gasoline flares and the trenches covered with unbreakable plate glass through which electric lights shine

the Germans, not content with the gasoline flares, dug two shallow trenches, both five hundred yards long and set two hundred yards apart inside the "L." These they lined with bright metal to serve as a reflector. A row of powerful electric lights was set in each trench. Over the top, heavy, unbreakable plate-glass was laid on a level with the surface of the ground. The pilot has only to glide down on top of the glass in order to make a good landing. If the power-plant should break down, so that no current can be obtained for the lamps, then the flares can be used.

The system betrays itself, however. The Allies fly over the illuminated aerodrome at night and drop bombs upon it. As a result, the Germans have had to use their lights only intermittently, and in some cases they had to abandon them.



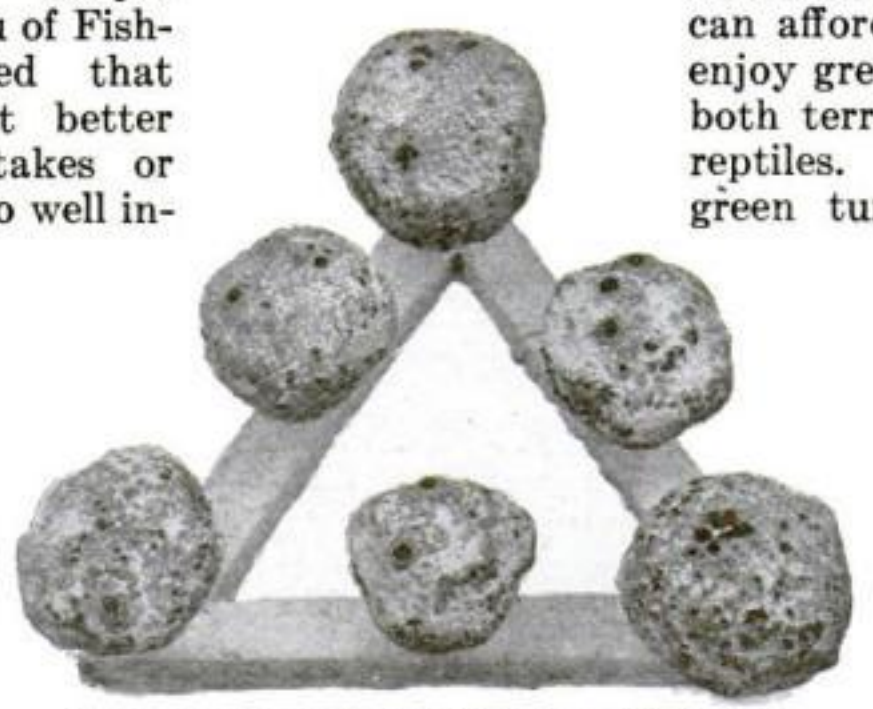
are placed covered with heavy, unbreakable plate-glass. The pilots have simply to follow the light and to land on the glass in safety. In addition to electric lights, gasoline flares are used

Raising Sponges on a Bed of Cement. The Sponges Like It

THINK of raising animals on slabs of cement placed on the bottom of the ocean! Of course we mean sponges; for sponges are merely simple animals. The Bureau of Fisheries has discovered that sponges like cement better than coral rock, stakes or copper wire—like it so well indeed that American sponge culture has grown from practically nothing into a million-dollar industry.

Cement disks and triangles have been used with great success in the sponge beds of Cuba and the Bahamas. The sponges readily attach themselves to the firm, clean surface and thrive on it. The disks, about ten inches in diameter and one and one-quarter inches thick, are composed of a mixture of one part of cement to three or four parts of sand. Two holes, about four inches apart, are made in each by thrusting an iron bar through the cement before it hardens. The disks can be made for less than two cents each.

The cuttings or seed sponges are attached to the disks in the manner shown in the photograph. A thin wire is generally strong enough to hold them securely to the disks. Each disk and triangle is numbered so that the Bureau of Fisheries knows the growth and behavior of the cuttings at all times.



Sponges growing on triangles of cement. Below: Thin wires attach the cuttings or seed sponges to the heavy cement disks

The pail has a glass bottom through which the fisherman can locate the sponges

Why Not Hooverize by Eating Lizards and Alligators?

MANY reptiles are edible and if sold under other names they would be palatable as well. Most of us eat diamond-back terrapin if we can afford it, and more of us enjoy green turtle soup. Yet both terrapin and turtles are reptiles. The eggs of the green turtle are said to be more nutritious than hen's eggs. Along the Amazon and Orinoco rivers in South America, turtle eggs form an important food item.

That lizards may be eaten seems more strange. Yet they were so popular a food in the Bahama Islands that they have been hunted almost to extinction. Florida alligators are said to be really delicious. Their appearance is certainly against them, but when carefully skinned, the flesh is no more repulsive looking than that of pork or veal. The taste has something of that of both fish and meat.

That Americans will ever eat snakes is more than doubtful. Just why they should be considered more offensive than eels or snails is a gastronomic problem. But large snakes are so scarce in this country that we shall probably never be called upon to conquer our prejudice. The pig and the oyster, both of which we relish, are unexcelled as scavengers by any reptile.

Gunning for Aircraft—How the Italians Do It

The pieces must be fired at their targets point-blank, just as a duck hunter fires at birds on the wing

WHILE it is true that no European strategist foresaw the important part that aircraft were destined to play in the present bloody conflict, it was at least realized that a man in the air had reconnoitering possibilities. Krupp even developed anti-aircraft guns to be carried on automobiles—weapons so clumsily mounted that they were of not much avail against a swiftly moving flying-machine. One of Germany's pioneer advocates of the military flying machine was Colonel Moedebeck. As far back as 1909, he predicted that only shrapnel could be effectively used against a prying air-scout—a prediction which has been amply fulfilled in the war.

How They Gun for Airplanes in Italy

Before the war no military engineer would have dreamt of mounting so heavy a piece on an automobile. Indeed, it would have been considered almost an engineering impossibility. But the necessity of attacking prying air scouts from constantly changing locations has made it absolutely necessary to achieve what seemed to be the impossible

How astonishingly anti-aircraft artillery has developed is evidenced by the accompanying photograph, taken on the Italian front. The earlier anti-aircraft weapons were rather small and were provided with elaborate range-finding devices. In a few months it was found that the pieces must be very much heavier than had been anticipated, and that they must fire at their targets, point-blank, just as a duck hunter fires at birds on the wing; there is no time for range finding.

As our photograph shows, the caliber has been increased enormously. The English and French have mounted heavy naval guns on field-carriages. Here we see an Italian anti-aircraft gun heavier than the piece which Krupp in 1910 designed exclusively for naval use, boldly mounted on an automobile truck. It is evident the truck is built for speed—evident because of the mud-guards.

The heavy shell fired by this Italian piece scatters a cloud of deadly bullets. Because of its power, the velocity of the projectile is maintained better than would have been possible with the feebler pieces with which Europe entered the war. Indeed, high power is necessary because of the altitude at which battle planes now fly for safety.

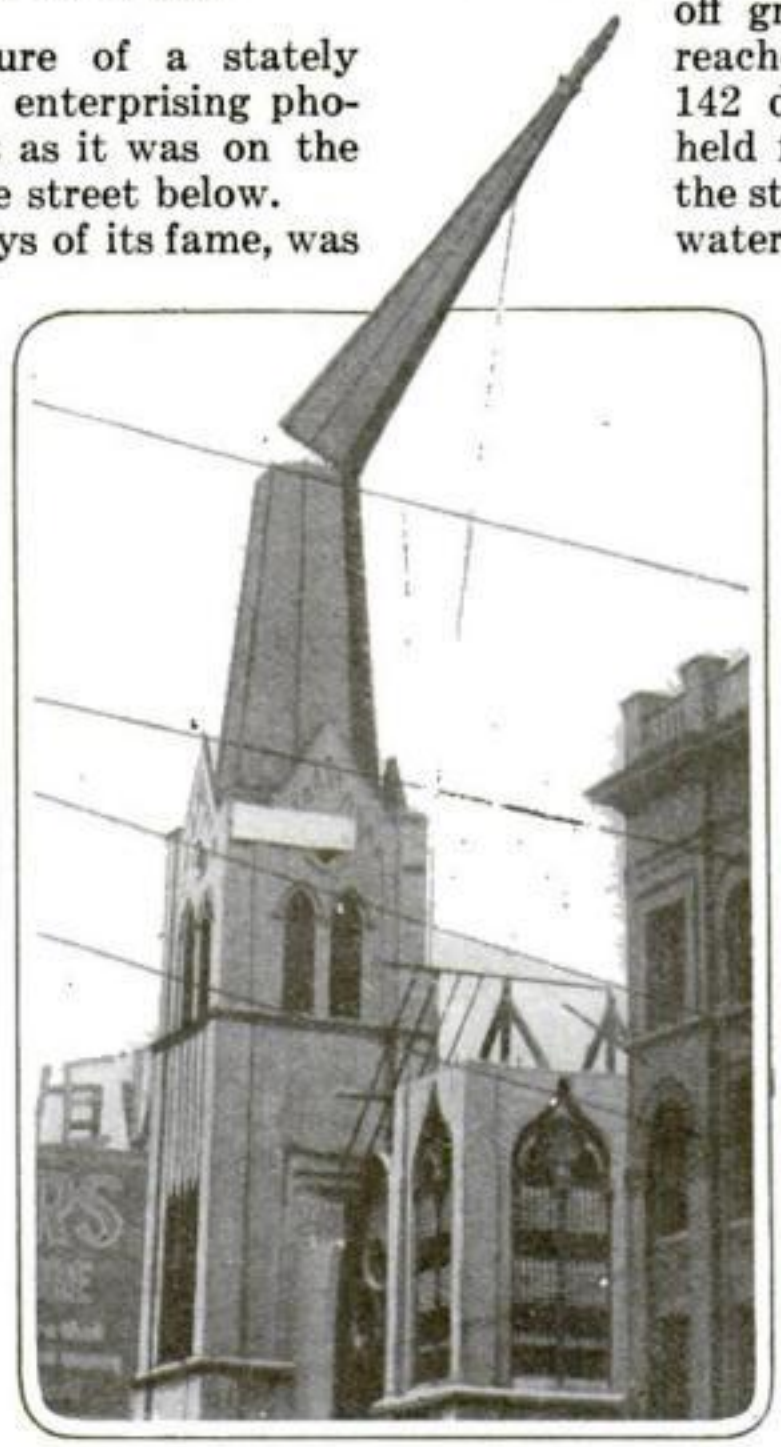
Such a heavy gun has a practically straight path at high angle fire; the projectile reaches its target quickly. It is hard at best to judge the point at which an airplane will have arrived to be annihilated by a shell fired from below. Hence it is of paramount importance to reach that point as quickly as possible.

A good pilot can avoid being hit by suddenly turning and twisting as soon as he sees an anti-aircraft battery open on him. Established batteries, whose location can hardly escape detection, are therefore at a disadvantage. But a gun like that here shown, mounted as it is on a swift automobile, has a better chance.

Going, Going! The Steeple Bows to Business in Portland

HERE is the picture of a stately church steeple an enterprising photographer snapped just as it was on the verge of plunging to the street below.

The steeple, in the days of its fame, was part of the Taylor Street Methodist Episcopal Church, of Portland, Oregon. For many years this was the finest church building in the city. Then the expansion of the business district enveloped the site, and the congregation sought another location for its house of worship. The building that is now being razed will be supplanted by a business block, but one floor will be occupied by a mission, to comply with a requirement in the deed, which states that the property must always be used for religious purposes.



This is not an accident. A wrecking company is removing an old landmark in Portland, Ore. A skyscraper supplants it

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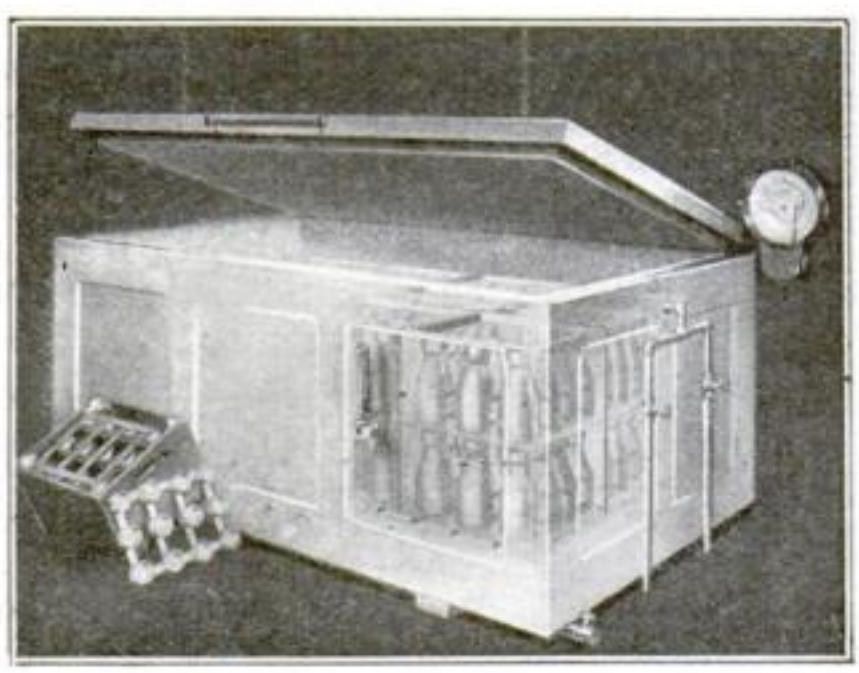
Pasteurizer and Ice-Box Combined—A New Convenience for Milk-Dealers

A MILK sterilizer, pasteurizer and refrigerator all in one, in the space ordinarily occupied by an ice-box, that's the newest dairy appliance. Wouldn't you want it, if you were a small milk dealer? It consists of a metal-lined box, provided with pipes for both live steam and water and with the necessary temperature gages. Steam is raised in a small boiler in which one bushel of coal is sufficient to pasteurize two hundred and fifty quarts of milk.

When ready to pasteurize, the bottles are first filled with raw milk. Then metal covers, like those shown outside of the box in the accompanying illustration, are placed over the tops. Bottles, wood crates and all, are placed in the box, the cover is closed, and the steam is turned off gradually until the milk reaches the temperature of 142 degrees, at which it is held for a half hour. Then the steam is shut off and cold water is turned on until the warm water, which naturally rises to the top has time to run off.

No ice need be used if a cold water supply is available. In any event, a few pieces of ice placed on top of the cases will keep the milk cold until it is ready to deliver. The pasteurizer then becomes an ice-box, and one which will pay for itself in eighteen months by the saving made in ice alone.

The delivering of milk is attended with many hardships anyway. The dairyman must frequently arise at three thirty A. M. to milk and get his product started for the city in time for morning customers. Any devices which will lighten his work are welcome. They are all too few.



A small milk-dealer can pasteurize two hundred and fifty quarts of milk at a time

The Nasal Flute—You Blow Your Soul Into It

GOOD things come slowly, which explains why it required ten years of experimenting on the part of Aurion V. Chevers, of East Providence, Rhode Island, to devise the musical instrument which he is holding to his nose. It is made of wood and consists of a hollow chamber with two holes for the nostrils and one hole for the mouth. Musical sounds are produced with it by blowing through the nose, and the tone and pitch are varied by closing or opening the mouth. In this way many tones can be produced.

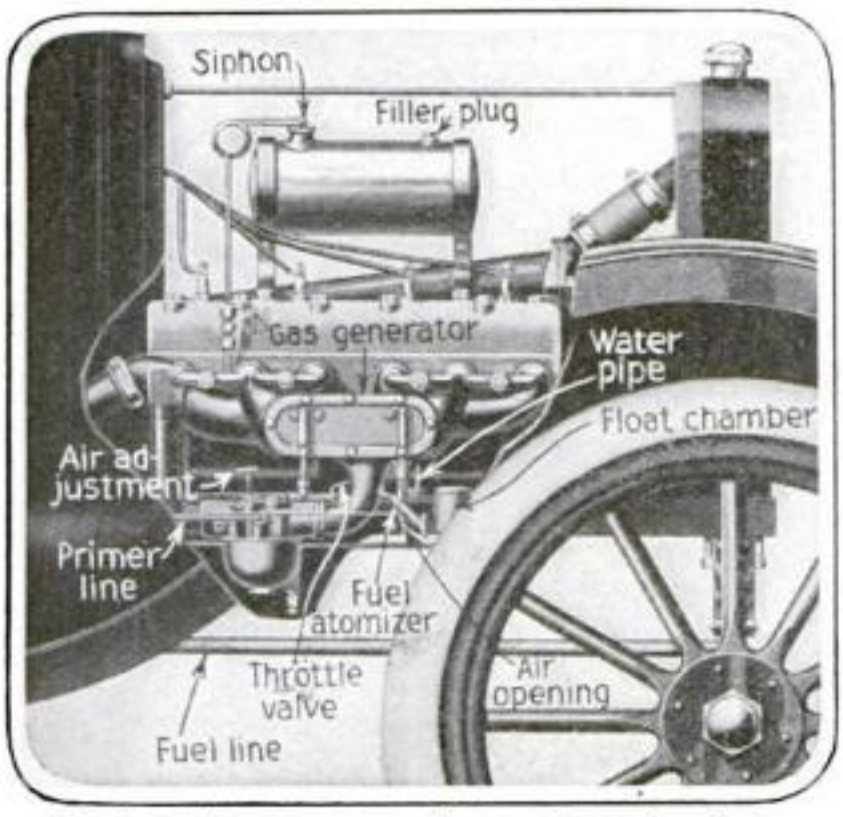
To play the flute, you place it against your nose and breathe as melodically as possible through your nostrils

A New Type of Hydro-Generator. It Moistens Gas Engine Fuel

THE new type of fuel-moistening device shown in the accompanying broken-away sketch is designed particularly for use on trucks. It consists of a special combined intake and exhaust manifold, carbureter and water tank. The water tank is mounted on top of the engine, underneath the hood, and feeds a small amount of water to a special nozzle which is incorporated in the carbureter float chamber.

The carbureter differs from that of conventional design, in that the float chamber and air-intake are in two separate pieces, several inches apart, the air-intake having a special bell-mouthed connection with the intake portion of the combined manifold. Between the air-inlet and the throttle valve, a special pipe leads directly to the intake manifold, through which the additional amount of air furnished, is controlled.

The water is syphoned from the tank into the special fuel nozzle, while the air is fed into the intake manifold through its own inlet. The fuel and water mixture striking the hot exhaust manifold is raised to a high temperature, the water turning into steam as it mixes with the air fed into the cylinders. As pointed out previously in the POPULAR SCIENCE MONTHLY, the admission of a small amount of steam with the atomized fuel tends to give greater power and to keep the engine cylinders free from carbon.



Fuel and water vaporize against the hot manifold. Steam keeps down the carbon

Canned Music for the Hindus in Their Native Language

AT Calcutta, talking-machine records are made in all the principal languages of India—Hindustani, Tamil, Telugu and Marathi. Though few natives of India, comparatively speaking, are rich enough to buy talking-machines, it is common for companies or individuals to tour the country, giving concerts with the machines. Before the war records in the native languages were—of course—made in Germany, but now they are produced only in India.

Living in a Giant Life-Buoy

Within are accommodations for
a dozen shipwrecked passengers

UNDERNEATH, the ship's engines vibrate steadily, the big propellers at the stern driving all on board nearer and nearer England.

Then comes a roar—a thud. All through the ship runs a great shudder. There is a violent rending and tearing, and up from the boiler-room comes a huge puff of smoke, the hiss of escaping steam, the shriek of dying stokers and the smell of fire.

There is no need for explanation. It is evident enough that a submarine has launched a torpedo only too effectively. Up on deck rush passengers and crew. Their one thought is the lifeboats. Has the ship lifeboats?

It has. They're of a new kind. They look like enormous tops all ready to spin. Inside are rows upon rows of seats. There are four or five of the giant boats (buoys they are) scattered along each side of the ship, next to the rail.

Into hatches in the uppermost side of these curious buoys (let's call them by their right name)—pour the people—so many to each buoy. The ship is listing rapidly. Also the fire seems to be gaining headway. Smoke rolls out of the stack and surges through openings in the deck and from cabin windows. At the far end of the ship water already reaches the rail.

Stragglers scramble madly about the deck. Suddenly hatches are clamped down on the lifeboats at the water-logged end of the great ship. The life-buoys half slide, half float off into the water, some of them dipping a fathom or two beneath the surface as a result of their momentum. In a moment, however, they bob up like corks.

Suddenly the looming bulk of the huge ship upends itself, water sliding in great sheets off of the exposed portion. Down the ship plunges, wallowing and eddying as it goes under, smoke and flame pouring from the superstructure. Stragglers and the life-

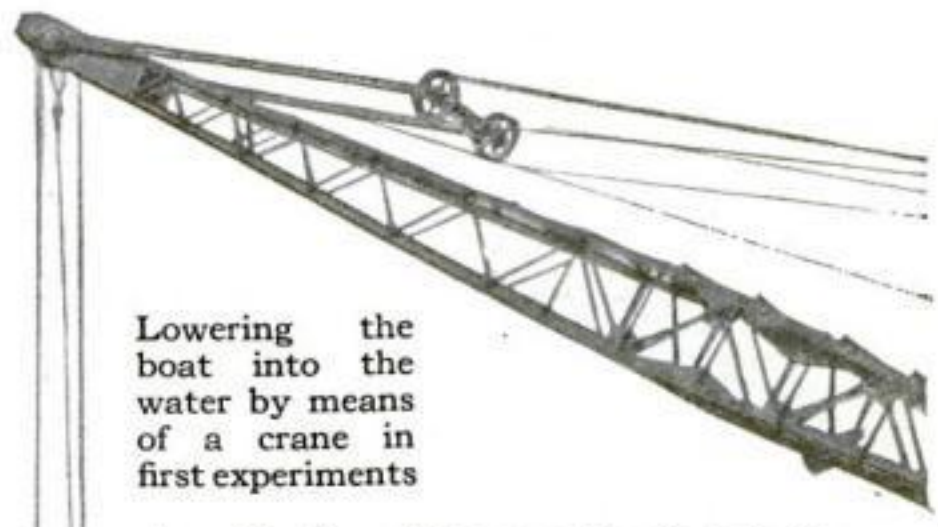
All that is left when the ship sinks, is a little colony of lifeboats, or rather, life-buoys, floating away from the wreck. Many people can be housed in relative safety inside

buoys still on deck are sucked along in its wake. Soon, however, the life-buoys reappear, and hatches fly open. Hands are put forth to gather in such floating bodies as come within reach. When quiet again reigns, the hatches are closed. Only a little colony of huge, bobbing, funnel-shaped buoys is to be seen where a short time before a great ship steamed along its course.

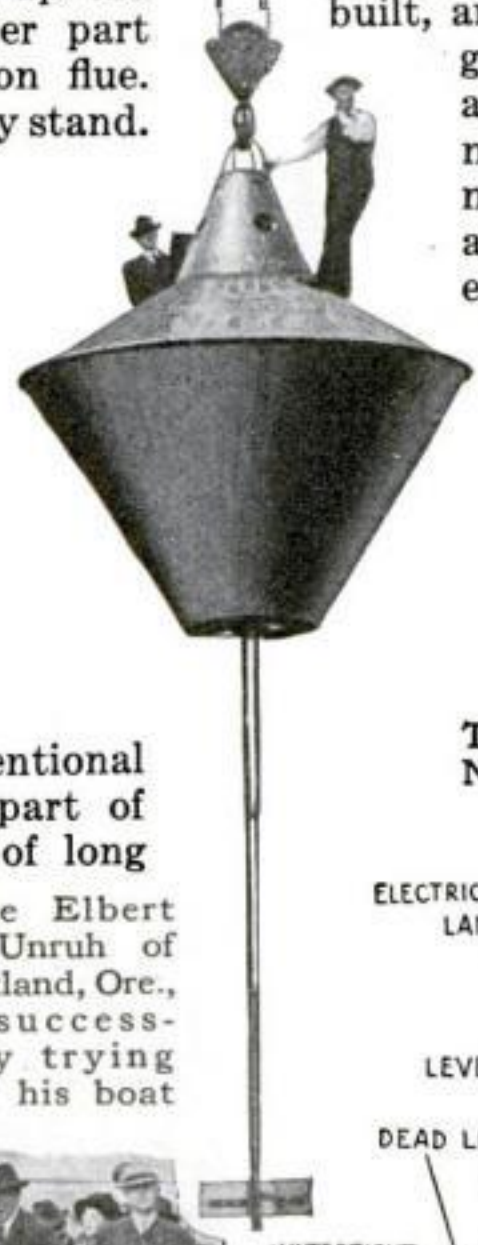
Inside the boats, the refugees are not wholly uncomfortable. The boats are roomy. People can be seated on several tiers of benches around the sides. A tank at the bottom provides drinking water and also serves as ballast. Storage-batteries and electric-lamps light up the interior. The periscope-like upper part of the craft acts as a ventilation flue. Here also the navigating officer may stand. It is impossible for water to enter as in an ordinary, open lifeboat. Even in rough weather, the refugees live in relative security. Electrically illuminated signal lights at the top, attract aid.

Thus Albert A. Unruh, of Portland, Oregon, would save life at sea. He has actually built one of his gigantic buoys, as our pictures show, and has demonstrated to his own satisfaction that the idea is sound.

Why do we cleave to the conventional type of lifeboat anyway? Is it part of the inertia that attends a craft of long

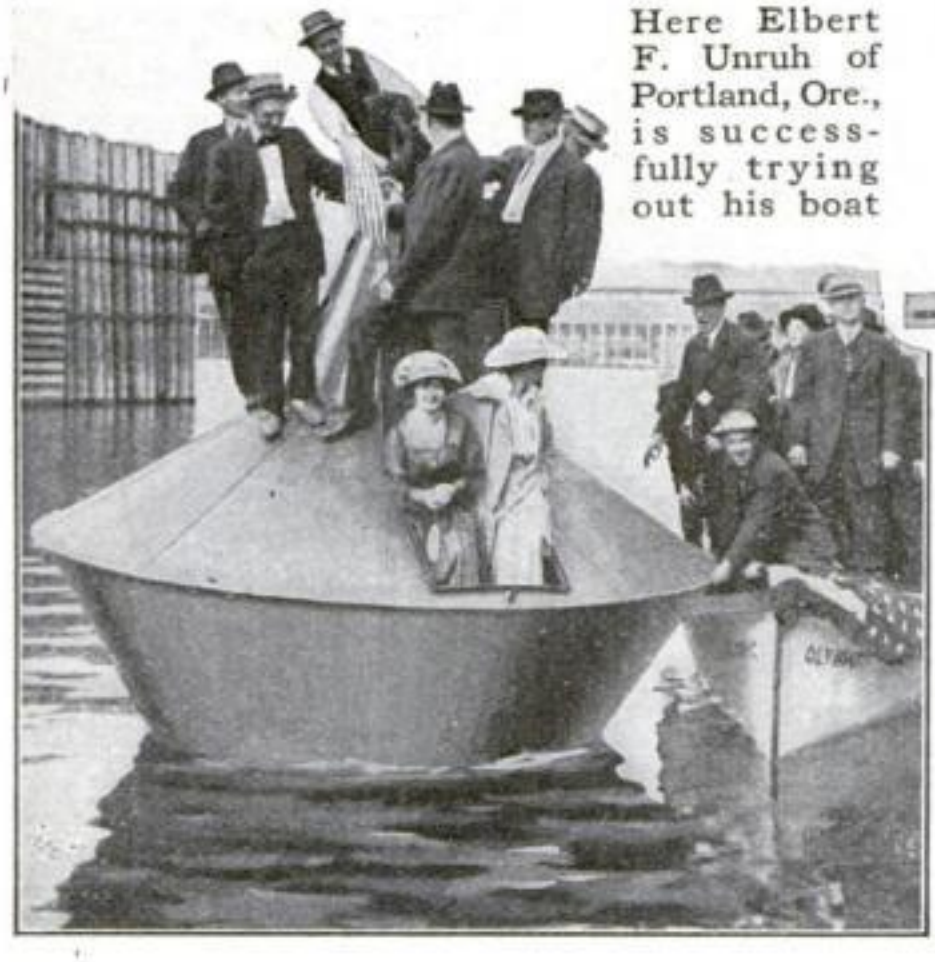


Lowering the boat into the water by means of a crane in first experiments



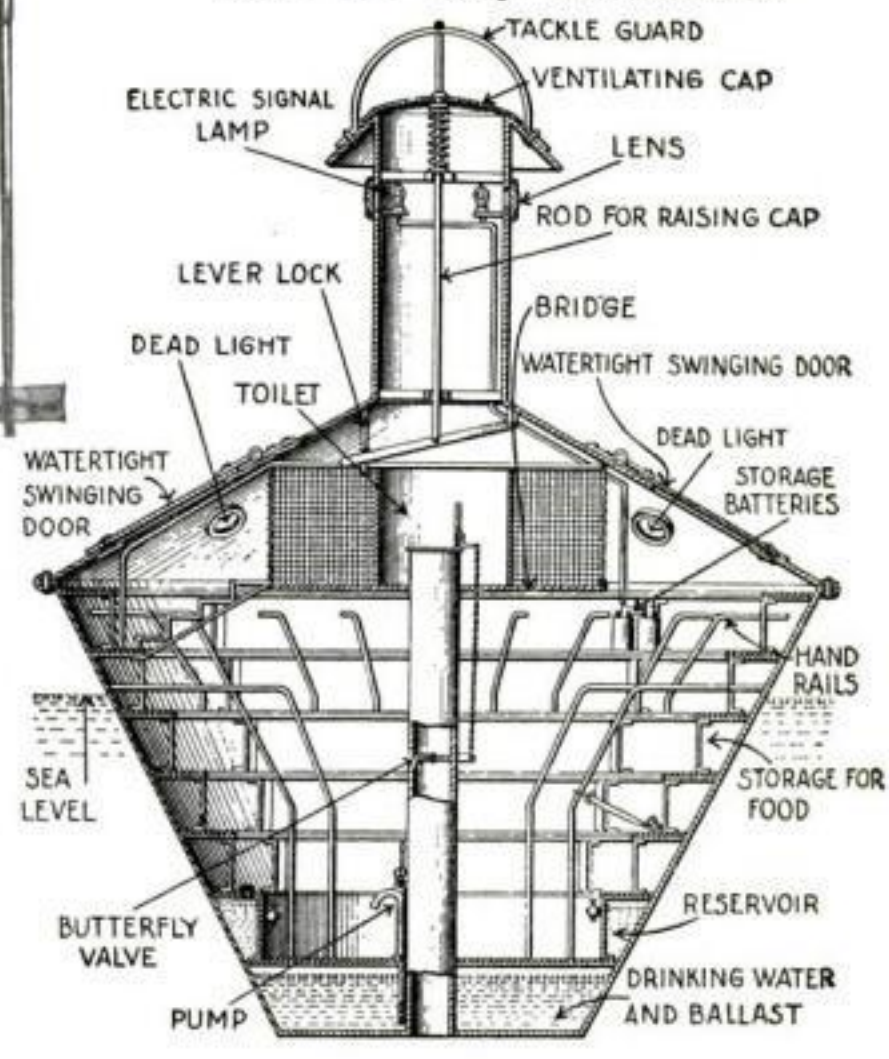
standing? Because the boats have always been built in one way, do we keep on in the beaten track without stopping to think?

It is true that boats, as currently built, are the result of evolution, and for getting over the water are perhaps as good as can be devised. But it must be admitted that the ordinary boat is not without its disadvantages when it comes to encountering a cold, winter sea, with no shield against the wind and no protection against any passing wave that wants to sweep over its sides and against the half-drowned, shivering occupants. Mr. Unruh's new lifeboat is a step in a desirable direction.



Here Elbert F. Unruh of Portland, Ore., is successfully trying out his boat

The interior of the lifeboat. Note the many conveniences



"Hands up!" commands the burglar, but the teller's knee presses against a button. A phonograph and telephone send out the necessary warning to the police

to the floor. In a moment he faces the teller again, this time with consternation written on his face. "How did you do it?" he asks.

"Pretty soft," mockingly replies the teller. "All I had to do was to press a hidden electric button under the desk with my knee. That little button caused a lifting device in the room adjacent to this to raise the receiver hook of a telephone. At the same time, a small-sized phonograph situated in front of the telephone transmitter repeated the message, "Help! Robbers! Send police to First National Bank!" Evidently the telephone girl heard it, for you were caught with the goods. By the way, you could have postponed your visit until to-night, but you would have been caught in the same manner."

The Thief's "Hands Up!" Is Answered by the Telephone's "Help!"

THE thief, face masked and pistol in hand, enters the bank and slinks up to the paying teller's window. "Hands up!" he commands. The teller does as he is ordered, sitting transfixed on his stool as the thief removes neat little piles of gold and silver from the window. In three minutes it is all over. The thief lowers his pistol, and, with the parting remark, "Pretty soft, old top," moves toward the door.

Hardly has he placed his hand on the knob before a dozen uniformed officers pin him fast

How Our German Prisoners of War Amuse Themselves

GERMAN war prisoners, from the big German liner, *Vaterland*, are converting the large detention camp, located at Hot Springs, N. C., into a really pleasant place. They have built woodcraft houses to live in and made many curious and amusing things from materials gathered from woods and streams.

An alligator shaped from a tree trunk. The teeth are only sharpened wooden pegs

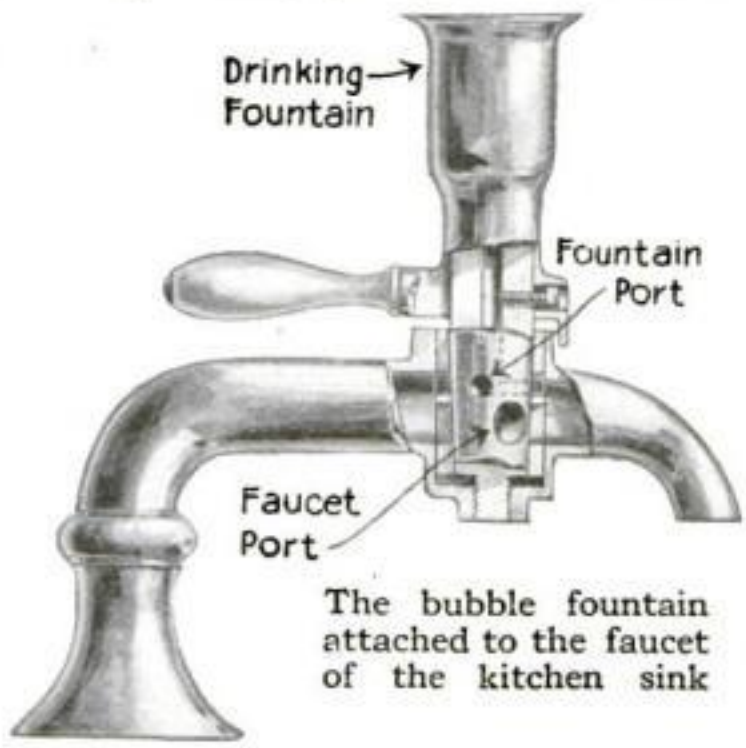
One of the curiosities of the camp is a big alligator, emerging from a hole in the ground. This was shaped from an old tree-trunk. One of the prisoners, skilled in woodcraft, has converted the stump into a strikingly lifelike reptile, its open mouth showing a double row of vicious teeth.

Safety First! Install a Bubble Fountain in Your Home

BELIEVING it to be unsafe for two persons to use the same cup, even in the home, Corrie F. Rudolph, of Washington, D. C., devised a bubble fountain to be combined with the sink faucet.

To drink from this fountain, you simply turn a horizontal lever to the left. This turns a two-way valve. One part of the valve rotates into position to connect the supply-pipe with the fountain, and you take your drink as the water bubbles over.

When you turn the handle-shaped lever at the right, the water is allowed to run out at the faucet for use in the regular way.



The bubble fountain attached to the faucet of the kitchen sink

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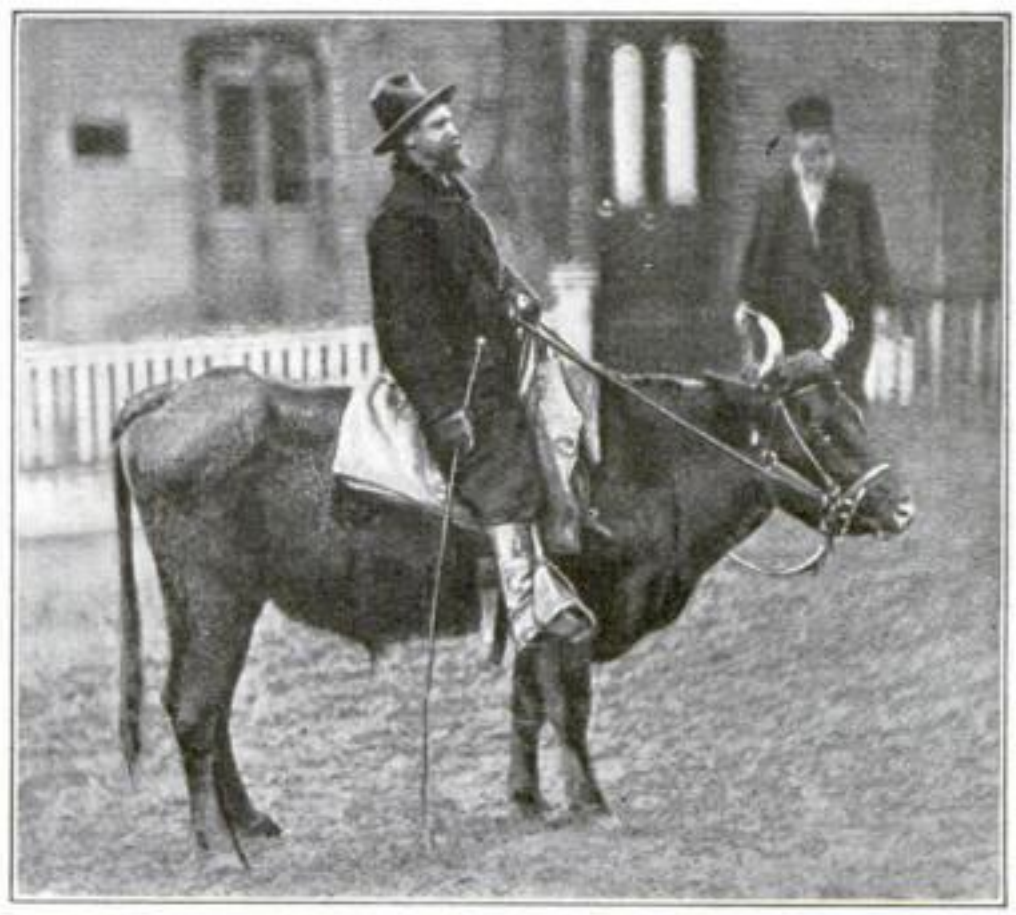
No Automobiles or Bucking Bronchos for Him. He Rides to Town on His Ox

THE statement that the New York subway is the safest transportation line in the world is open to doubt. In South Glens Falls, New York, there is a one-passenger line which is the safest ever—and the oldest, by the way. Every morning one of the townsmen saddles his faithful ox and with switch in hand, he comes to the village for his mail and supplies. It takes him a few hours to make the trip, but while his neighbors in their automobiles pass him on the way, he does not envy them, for the price of gasoline and the danger of skidding around corners, to say nothing about head-on and rear-end collisions, worry him not.

The only expense connected with the maintenance of the one-ox line is the feed necessary to keep the animal going. Once you get its machinery in motion, you can forget about it, which is more than any automobile owner can say.



Of course, he never worries about arriving anywhere, but when to start is one awful uncertainty

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Enlist in the U. S. Air Service

THE aviation section of the Signal Corps is looking for skilled American workers for service abroad. To bring up supplies and ammunition, and to construct and maintain the airdromes, squadrons of picked men are needed. All men who enlist will be given special training, according to their vocations, in work required for the air service.

The following kinds of skilled workers are needed immediately: Chauffeurs, automobile mechanics, engine repair men, office clerks, carpenters, radio operators, electricians, cooks, coppersmiths, expert photographers, machinists, stenographers, mechanical draftsmen, metal workers, motor cyclists, plumbers and painters. Applicants must be physically sound and of military age. Go to your nearest recruiting station and you will receive full information, or write to Volunteer Bureau 119 D St., N.E., Washington, D. C.

Viewing them in comparison with a thimble, emphasizes the diminutiveness of the seedling potato plants

The Wise Potato. It Refuses to Produce Unnecessary Seeds

POTATO seeds are so extremely rare that it is almost impossible to obtain them. Yet seeds of potatoes are plentiful. These facts seem diverse and antagonistic; they are easily reconciled. About twenty-five years ago potato balls were abundant wherever potatoes were grown, but in our modern intense cultivation the plants seem to have learned in many sections that it is not necessary to bring to fruition the tomato-like balls that should be the result of the bloom.

Potato seeds can be obtained from certain places, mostly outside of the United States. The potato propagator values these seeds highly, because from them, and preferably from the modern well-cultivated plant rather than from the primitive wild potato, the seed should be obtained for propagating new varieties. For the first year the plants are diminutive. The first year's crop of tubers is limited. These potatoes, about the size of peas or even smaller, are planted the second year. The tubers thus obtained are a little larger. Usually in the third year some will be found that are really worth while, and perhaps a new variety that is worth cultivating. Extensive correspondence on the subject has been carried on by Edward F. Bigelow, of Arcadia, Sound Beach, Connecticut, with potato growers in all parts of the country and has brought forth a great variety of claims and experiences.

Saving Man Power in Loading Freight Cars

THE tread-mill of the farmer boy's youthful days is now being employed in principle to lessen the number of men required to load freight cars. The device consists of nothing more than an endless belt-conveyor or stairway from the ground to a platform level with the freight car door.

This makes it unnecessary for the men to rush the incline as they must on the ordinary runway, and this in turn prevents them from becoming exhausted before the day's work is over. It also reduces the number of men required to load any given amount of goods, and the laborers so released can be employed for more vital war work.

The tread of the stairway is provided with small cleats to prevent the man and his hand-truck from slipping

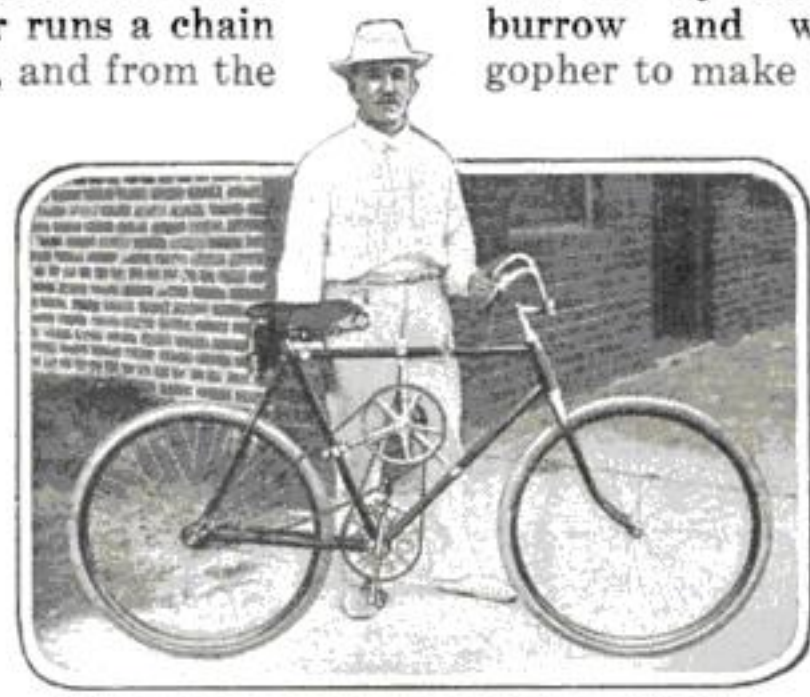
The same kind of a tread-mill can be used for loading motor trucks. It is operated by a small electric motor underneath the platform. The motor can be shut off to save current when no loading is being done.

As the men must work quickly because the incline moves fast, more is accomplished.

Another Inventor Renders a Service to Humanity

CONSIDER the picture on our right. In it we see a gearing-up attachment for a bicycle. It consists of a Y-shaped steel forging affixed at its three ends to the bicycle's frame. At its center revolve two sprocket wheels mounted on the same shaft. Over the smaller runs a chain from the pedal sprocket, and from the larger another chain goes to the sprocket on the rear hub. The net result is to gear up the machine.

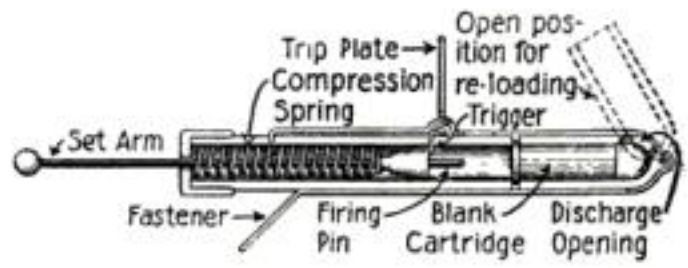
The attachment is supposed to increase a rider's speed by one-third, though lessening the former number of pedal revolutions required by one-half. But what about the immensely greater pushes on the pedals necessary? Such a contrivance may be useful on level boulevards. But even a small hill would put it out of business.



New attachment to gear up a bicycle. It also "gears up" the work you must do

Making the Pesky Gopher Commit Suicide

CALIFORNIA and other western states have two sorts of game that are always in season. One is the gopher, which is not a turtle, as he is in the South, but a burrowing pest; the other is the ground squirrel. Both are nuisances, and both are under the sentence of death when it can be executed. To help in carrying out that sentence, a western inventor has worked out a burrow gun. It has a cylinder containing a cartridge and firing mechanism, with a flat plate projecting from the side and taking the part of the trigger. When the gopher comes burrowing along, shoving fresh dirt ahead of him, he touches off the trigger, and the gun goes off. This is hard on the animal, but affords keen pleasure to the boy who has sat by the mouth of the fresh burrow and waited for the wily gopher to make its appearance.



Pushing the dirt ahead of him, the gopher sets off the trigger and shoots himself

Cutting Down Engine Weight

THE lighter an airplane is the faster will it fly and the farther it will go. Hence the lighter the engine is the more successful will the airplane be. The one follows from the other. In the development of the airplane motor into the remarkable machine it is to-day, this "weight efficiency" has become very high. It is little known how important was the part played in the development by a most simple device, originally invented for preventing the escape of gas from a breech-loading gun. This device is a cup-shaped piece of metal, now attached merely to the ends of the pistons of the airplane motor. Like its use in the gun, it checks the escape of the expanding gases. The greater the pressure of an explosion in the engine cylinders, the harder will the edges of the metal cup be pressed against the walls of the cylinders. Hence the less chance will there be of the gases leaking around the sides of the piston. The power in every portion of the exploding gases is therefore used, and none seeps away.

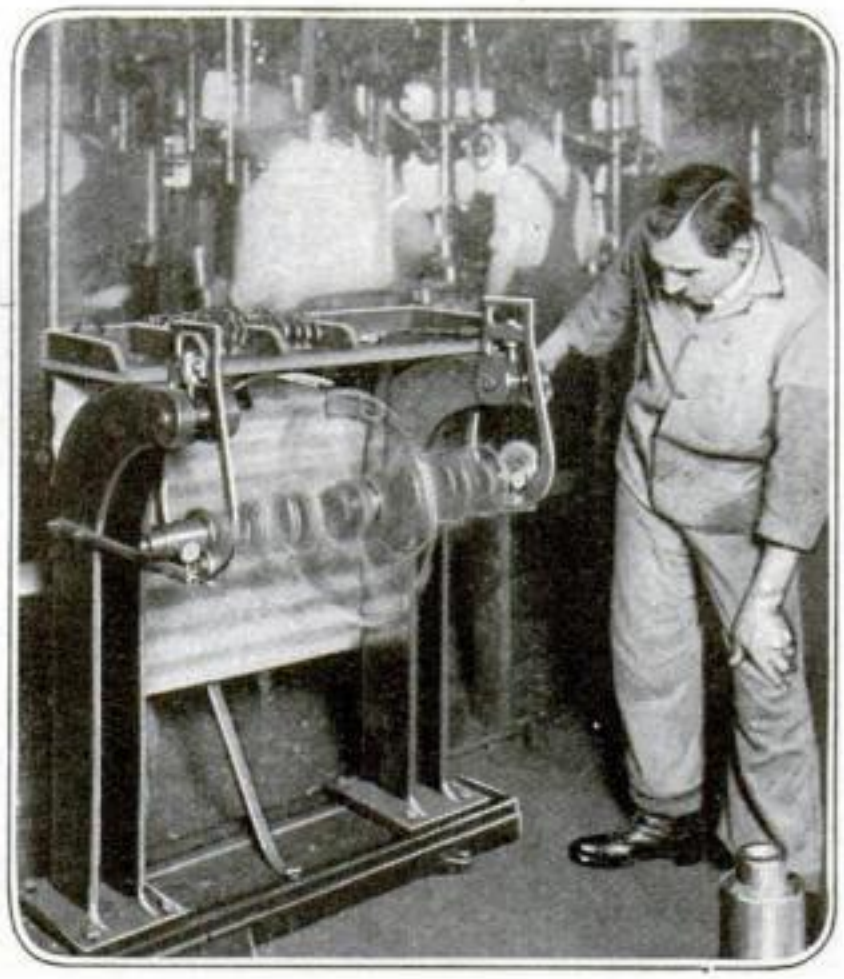
Wait until we get to transmitting power to airplanes wirelessly! Then a light electric-motor of great power can be used. New fields will open.

Balancing Crankshafts With Air-Turbines

IN the early days, when the problem of the automobile manufacturer was to make a car run at all, rather than run economically and smoothly, balanced crankshafts were unthought of. But as the buying public began to demand cars with smooth-running engines, in order to reduce the unpleasant effects of excessive vibration, the automobile engineer had to devise some method of equalizing the power impulses transmitted to the driving shaft of the automobile at each cylinder explosion. And so he hit on the method of weighing all the pistons and connecting rods, and classifying them according to their weights, in order to be sure that the reciprocating mass of each cylinder was equal to that of any other cylinder in the same engine.

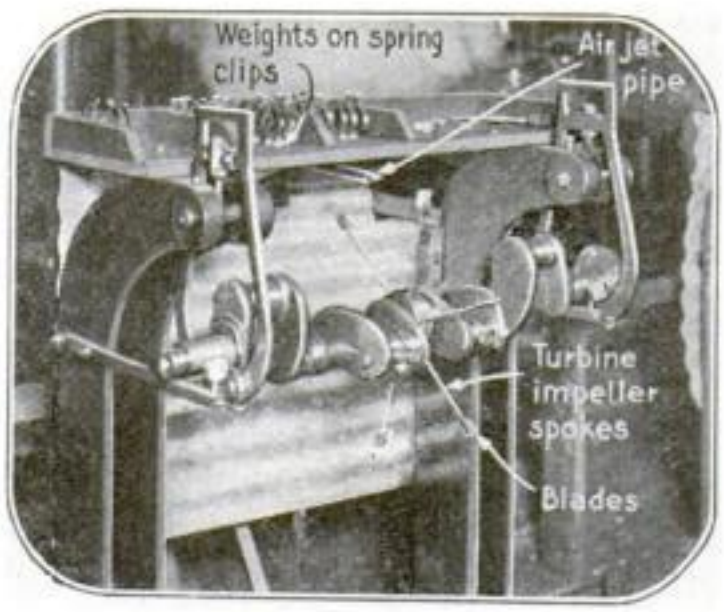
But balancing the crankshaft was a far more difficult problem, since it is in one integral piece which serves all the cylinders of the engine. In the old days, the only way to distribute the weight of the crankshaft properly on all the cylinders of the engine was to get it in static balance, which means in such a position that when placed on two knife edges, one at either end, the shaft would remain in that position without revolving.

While this kind of balance was easily obtained by the trial and error method of turning the shaft and then cutting off portions of the crank-arms to make the shaft balance, it did not necessarily follow that either the engine or the shaft would be balanced when it was rotated, as when turned in the engine itself. Two equal weights on either side of the center will balance well even though one weight is all on one piston and the other all on another. Unequal distribution makes no difference. But, nevertheless, the piston to which the heavy weight is attached will push down with a harder force at each revolution than the one next to it. Hence the engine runs unevenly, even though the weights are balanced. Excessive vibration is set up, so that the engine wears out quickly, and the passengers are constantly jarred and shaken.



The Air-Turbine In Action

The crankshaft is carried on two pivoted stirrups, thus leaving it entirely free to turn about its axis without being affected by its mechanical means of rotation. The turbine wheel, which has six spoke-like arms, each with a flat blade at the end, is turned by a jet of compressed air issuing from a pipe on a level with the highest position of the blades. Two micrometers, in contact with the ends of the shaft, show the vibrations of the shaft if it is out of balance, and small weights are then attached to the shaft by spring clips as shown. These indicate at exactly what points metal must be cut off in order that the shaft may be balanced perfectly



The turbine when not in motion. Its mechanism is clearly indicated

The demands of the American automobile-buying public for smoothly-running cars has necessitated the development of some simple method of balancing the crankshafts of such engines at a rate which will not

interfere with the great quantity production for which our cars are famous. In handling this work, makes use is made of an air-turbine to revolve the shaft by means of a jet of compressed air impinging upon the surfaces of the vanes of an impeller, mounted directly on the shaft. One of the unusual features of this method is that the method of rotation does not affect the actual or apparent condition of balance of the shaft which is being tested.

An Antique Chinese Water-Wheel Irrigates a Modern Colorado Orchard

A COLORADO apple-grower irrigates his orchard with a water-wheel of the antique Chinese pattern. This primitive device supplies his fruit trees with ample moisture at a cost of only eighty-eight cents an acre, while his neighbors, who purchase water from an aggressively modern irrigation ditch pay four dollars an acre.

Water from a small dam furnishes the power which drives the water-wheel. The wheel is provided with buckets, which carry the water to the top, where it is emptied into the box-troughs, shown in the accompanying illustration. From the troughs, the water is distributed, as needed, to various parts of the orchard.

A Corrugated Hull Increases the Speed of a Ship

THE fact that corrugations in a ship's hull lessen its resistance to the water was discovered by mere accident. A. H. Haver, an English naval architect, was making various experiments in a Caws pendulum tank. This pendulum tank is simply a large tank of water over which a pendulum is suspended. To the bob of the pendulum a model of a ship is attached so that the swing of the pendulum draws the model horizontally through the water. The arc of the swing measures the resistance of the model to the water.

An experiment was made with a model having plain sides, and a certain result was obtained. Then corrugations were made in the hull of the model. Instead of reducing the swing of the pendulum on account of the increased wetted area, as was confidently expected, the corrugations increased it.

This proved that the resistance of the ship to the water was decreased in proportion as the wetted area was increased. The conclusion naturally followed that a ship with corrugated hull would possess a greater speed than one with a plain hull. It is not possible, however, to conclude that the increase in wetted area is the cause of the greater speed.

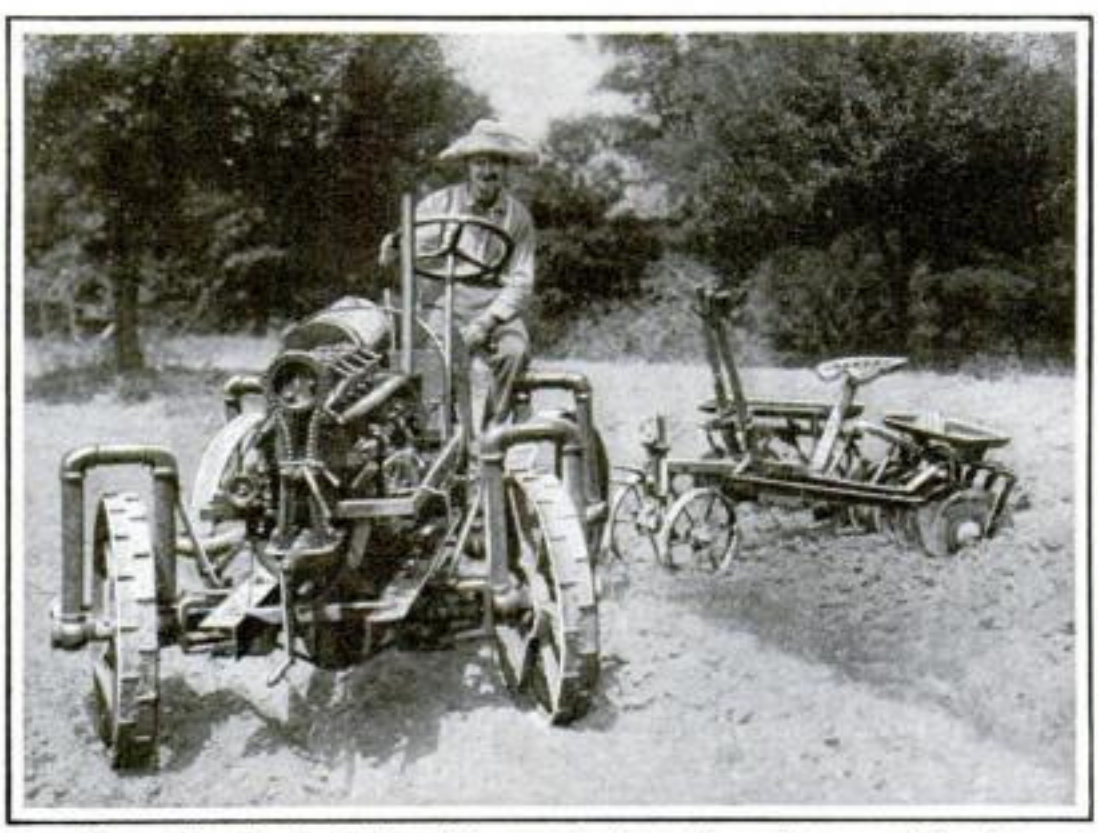
This water-wheel is provided with buckets, which carry the water to the top, where it is emptied into the box-troughs, from which it is distributed about the orchard

New Farm Tractor Driven by All Four Wheels

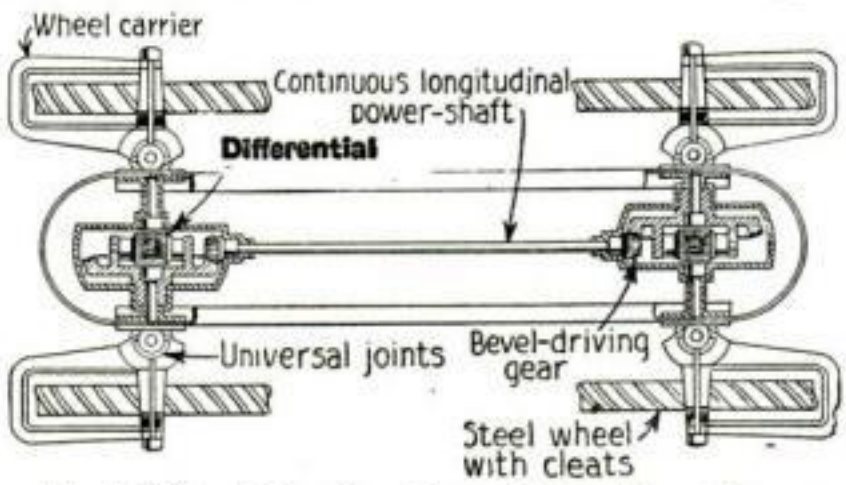
OSCAR D. Bowles, an inventor of Seelyville, Ind., has produced a farm tractor which is very hard to mire even in the softest kind of ground. It applies the all-wheel drive and steer of the French tractors, which haul artillery. The vehicle has four wheels, two at the front and two in the rear in the conventional arrangement. Each wheel receives some of the propelling power delivered by the gasoline-engine. If the two front wheels are mired in a soft spot and begin to spin because of lost traction, the rear wheels, if they are on solid ground, can pull the vehicle through.

Each wheel is carried on a universal joint, so that all four wheels aid in the steering. In turning a corner, the rear wheels track with the front ones, thus reducing the turning radius and making it simple to turn furrow corners without loss of time.

Although, as we have said, the all-wheel drive and steer is applied in all French military tractors, Mr. Bowles assures us that he has been working on his invention for thirty years. Even well-informed technical men tried to discourage him, arguing "It can't be done." But Mr. Bowles did it.



The all-wheel drive illustrated, makes it exceedingly difficult to mire the tractor even in the softest ground



Each Wheel Receives Some Propelling Power

This unusual tractor is four-wheel driven and steered, that is, each wheel receives some of the driving power to push the vehicle along and also aids in the steering. The power is supplied to each wheel from the engine, above the frame at one end, by means of a central, longitudinal shaft running from the front to the rear axle. The drive is through a bevel gear and differential at each end. Each differential has universal joints on its opposite sides. These are connected with the center of each wheel, so that it may turn for steering. Each joint is held in its proper position with the frame by means of a hinged knuckle joint and the wheels are held perpendicular to the joints at any angle by pipe carriers which run over the tops as shown in the diagram.

Honey of Grapes—An Attractive Sounding Substitute for Sugar

IT would seem that almost every fruit but the lemon has been considered as a sweetener since the sugar shortage has become a problem. But few substitutes have been even usable.

The question of obtaining sweetening substances from plants and fruits has naturally been studied by scientists. The Italian Government, through its experiment station at Asti, has been experimenting with Honey of Grapes which is produced by a special process and a patented apparatus, discovered by a Professor Monti.

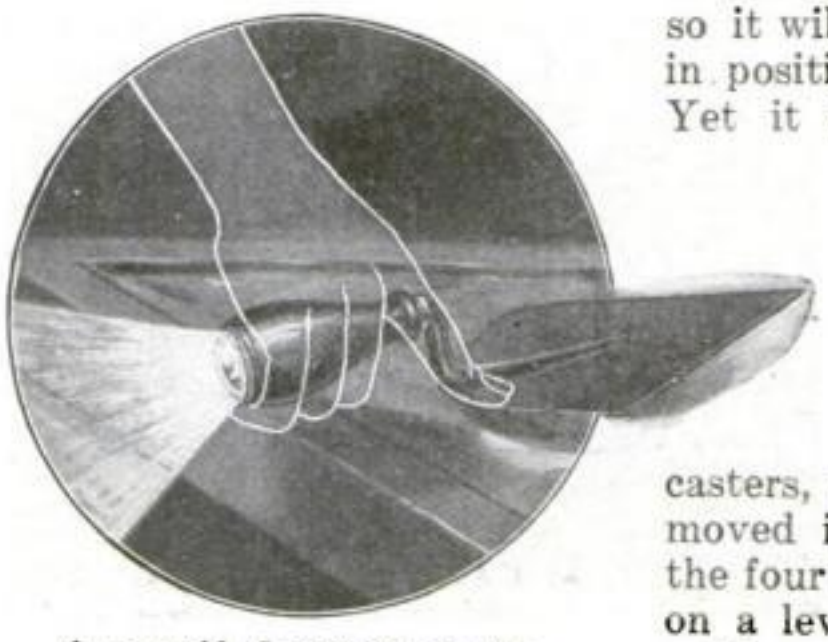
The substance is a grape sugar resembling honey. It is obtained through evaporation, and as it contains no water, it does not change in quality even if conserved for a long period. This is a great advantage over other sugars. It is especially useful in the preparation of jellies and preserved fruits as well as in the manufacture of fruit sirups for non-alcoholic beverages.

At Asti, only a small model of Prof. Monti's apparatus is employed, but a concentration of fifty-five per cent is obtained from grape liquor, which at the beginning has only sixteen per cent of sugar in solution.

Look into the Mysteries of a Mold with an Electric Trowel

OUT in Brainerd, Minn., lives Thomas A. Gatten, an expert molder, who fussed in the semi-darkness of an iron foundry, trying to get the sides of his mold just right. Sometimes he captured a little extra light by the bothersome expedient of holding a hand-mirror with his left hand while he worked with his right. Thousands of other men have done the same for years, and at the same time have made remarks—strong remarks.

One day, a bright idea came to Gatten while he was at work in some dark corner. Why not illuminate the mold by electricity? With this thought he set to work and invented a little electric lamp and battery to be sunk into the handle of his trowel—or into any other tool handle for that matter—that would furnish light where it was needed and when it was needed by the mere pressure of his little finger, as shown in the cut. Lights off—you have the ordinary molder's trowel, except that the end of its handle is decorated with a powerful little bull's-eye. Lights on—and you have a chance to see just what you are doing in a dark hole. Gone is eye-strain, inefficiency and the necessity for strong language. Mr. Gatten has given the world another of the little things that count.

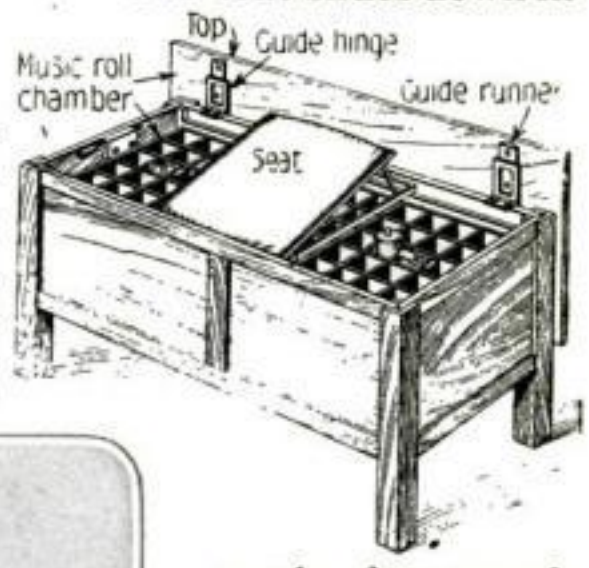


A small flashlight in the handle of the trowel enables foundrymen to inspect molds

Here It Is! The Adjustable Player-Piano-Bench and Record-Holder

THE combination piano-bench and record-holder shown in the accompanying illustrations is heavy enough to be perfectly rigid, so it will always remain in position when in use. Yet it is easily moved from its place and pushed back against the wall out of the way. This is done by means of casters, which are easily moved into place under the four legs, by pressure on a lever.

The seat slides down into the framework, and is covered by the top covering-boards when not needed. When the seat is to be used, the covering-boards slide back and down, and the seat is raised to any convenient height. Inside the frame, there are partitions to accommodate sixty records. The seat slides along from one end of the frame to the other, so that the operator can select his record without getting up.

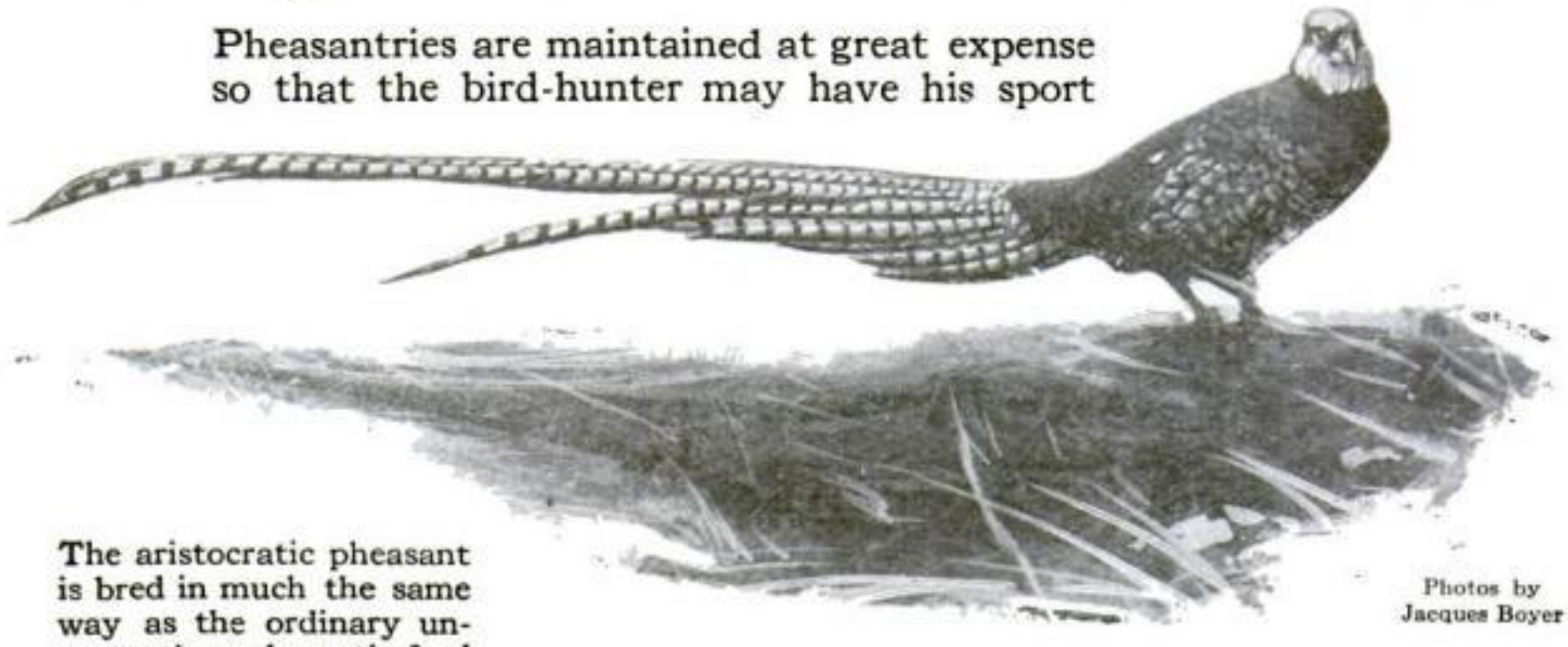


Combination seat and record holder, with top covering-boards slid back and the seat in its position

Inside the frame, partitions accommodate sixty records. Each record is easily reached

Raising Birds for the French Hunter

Pheasantries are maintained at great expense so that the bird-hunter may have his sport



The aristocratic pheasant is bred in much the same way as the ordinary unpretentious, domestic fowl

Photos by Jacques Boyer

THE pheasant, which is commonly bred in France for stocking the woods for the hunters, is raised, in a general way, like the common fowl, but it requires much more careful feeding. The pheasantry is located on some dry, slightly elevated ground not far from the woods where the birds are to enjoy their short span of life. If the breeder has not secured his cocks and hens during the hunting season, he buys the eggs for breeding from a reliable dealer. But if he has the birds, he is surer of results. The egg-laying period varies with climatic conditions, but ordinarily the hens begin laying in captivity about the middle of April, each laying about a dozen eggs during three weeks.

During the laying time the birds are fed plentifully on oats, barley, hemp seed and a mash made of honey, bread, herbs and chopped eggs. Green food, such as lettuce, dandelion and chickory is also given generously. The eggs are marked with the date of laying and deposited, large end up, on a bed of bran in a wooden box. The eggs are placed under ordinary domestic hens for hatching.

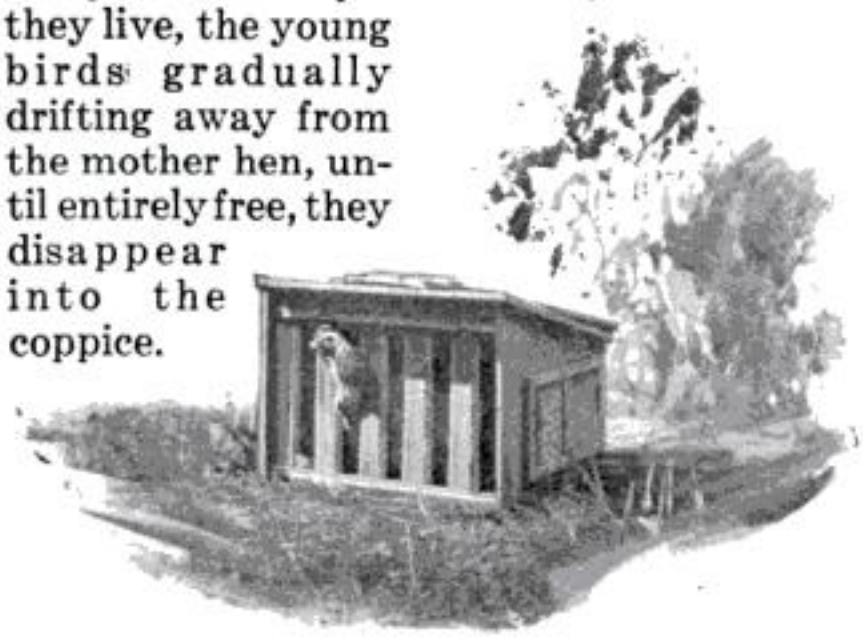
At the Rambouillet pheasantry, in France, the incubator chamber is a hermetically sealed compartment on the ground floor. Round or oval wicker baskets are arranged in rows in this chamber and buried to three-quarters of their height in the fine sand with which the floor is carpeted. The bottom of the basket is then covered with finely chopped straw and hay, and from fifteen to eighteen eggs are placed in it. A hen is placed over them and a cover intended to keep the hen on her job is placed over her. Incubation lasts twenty-four to twenty-six days.

The pheasantry is located on some dry, slightly elevated ground not far from the shooting preserve

In large pheasantries, artificial incubators are sometimes used when setters are lacking or to commence and finish the work. The best types of apparatus,

however, cannot equal the setting hen for results. Early in May hatching begins. Then for three weeks the chicks require great care. They are placed in a box filled with cotton wadding, and covered with a light quilt to dry, after which they are placed in the brooder. After about a week, they are placed in runs, in a grassy clearing, carefully protected against foxes, hawks and other marauders.

The daily bill of fare is carefully prepared. The first meal, on the day after the hatching, consists of ant-eggs. From the second meal this diet is varied by green food and a mash, of which the base is hard boiled eggs and stale bread. The moulting season, which often decimates pheasantries, is reached at the end of the second month. The breeder has now to redouble his vigilance in order to keep the chicks from damp and chill. Finally during the first two weeks of July the young pheasants are taken to the thickets or woods. They are carried at night, coop, mother hen and chicks, from the pheasantry to the spot selected, and there they live, the young birds gradually drifting away from the mother hen, until entirely free, they disappear into the coppice.



Hens are used to hatch out the pheasant eggs. Incubators have never been so successful

The young chicks must be carefully protected against foxes, hawks and other marauders

If You Can Stop An Automobile, You Are Fit to Run One

RUNNING an automobile through traffic is like swimming in deep water. Don't do it until you are so sure of yourself that all danger of panic has gone by. And always expect the unexpected. Leave your family or friends at home on those first few rides.

As your initial lesson, after you have learned the names, and above all the potentialities of the various levers, learn how to stop. Of course, as a preliminary, you must start, but that can be at your leisure. Make a dozen—or even a hundred attempts to bring the car to a standstill until you have gained confidence. Then adventure along some quiet, unobstructed road.

After you have received some instruction about the general mechanism of the car, practise stopping suddenly before reaching imaginary dangers along the road. Don't wait for this lesson until a child, a chicken, an absent-minded saunterer or some other irresponsible live thing sends your brand-new knowledge helter-skelter.

Measuring distance accurately is the most important feature of driving. Draw two lines across the road fifty feet apart. Then, going at the rate of twenty miles an hour, apply the brake and see how long it takes you to stop the car. When you discover how much over the fifty-foot line your automobile goes, you realize the necessity for the driver's first rule—caution.

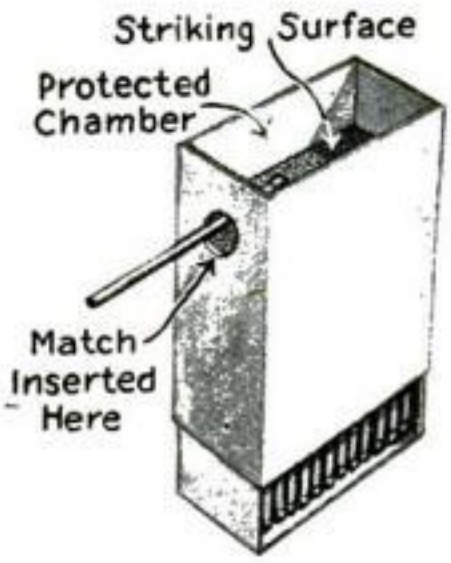
This trial also teaches you what speed is safe in approaching railroad crossings and intersecting streets, and how near you can go to traffic before applying your brake.

Use This Match-Box to Light Your Cigar in the Strongest Wind

NOW comes an invention, patented by George Frank Waugh, a private in the United States Army, which seems to solve the difficulty of lighting a match in a wind. The device is simple. A small, round hole is made near one end of the cover of an ordinary match-box. Some abrasive material is pasted on the corresponding end of the tray itself.

This match-box provides a small protected space in which a match can easily be lit in spite of drafts

In order to light your cigar, slide open the cover of the box until the hole is free, insert your match in the hole and strike it on the abrasive material on the end of the box. The released end of the cover provides a small walled-in space, in the shelter of which the cigar can be quickly and conveniently lit.



Cook With Acetylene Gas on the Farm

THE country housewife need no longer use an old-fashioned range, even if her home knows not gas or electricity. The home acetylene heating apparatus can be used, with excellent results, for cooking. There is no odor from the flame. The food is just as untainted as if it were cooked over wood or coal.

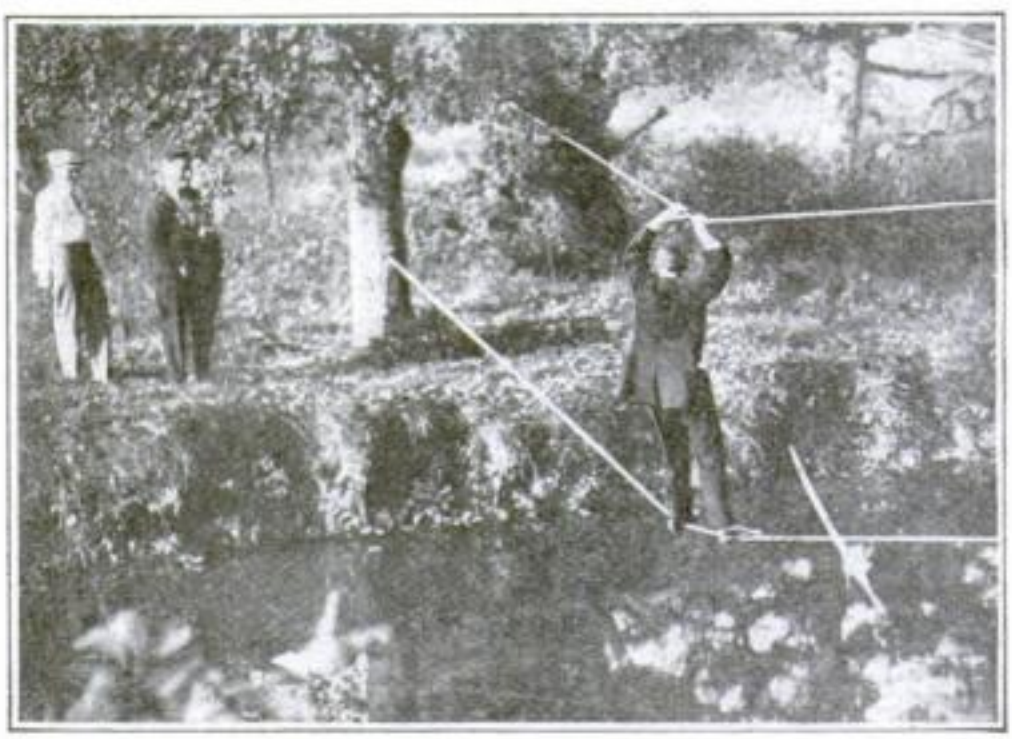
Since the acetylene stove need be lit only when in actual use, there need be no superfluous heat in the kitchen during the greater part of the day. Burners are so constructed that any desired amount of heat is obtained without delay.

Some accessories for the household are instantaneous water-heaters, flame spreaders for heating flat-irons, broilers and a gas-heated flat-iron.

Cultivating Nerve by the Rope Bridge Route

WARD W. BEAM, a Quaker City physical culturist (of course he is a "professor"), has his own ideas about the right way to make the body subservient to the will. First and foremost he cultivates "nerve," by teaching his students to do seemingly impossible feats.

He takes his pupils into the country, selects a suitable stream and builds a rope bridge across it. One rope is a hand support and the other a precarious foot-bridge. He tells his pupils to cross the stream via the rope route. Once started, they have to keep going or get a bath. Both women and men are able to negotiate the crossing with comparative ease after they have once done it. As Professor Beam assures them, it is only a question of "nerve."



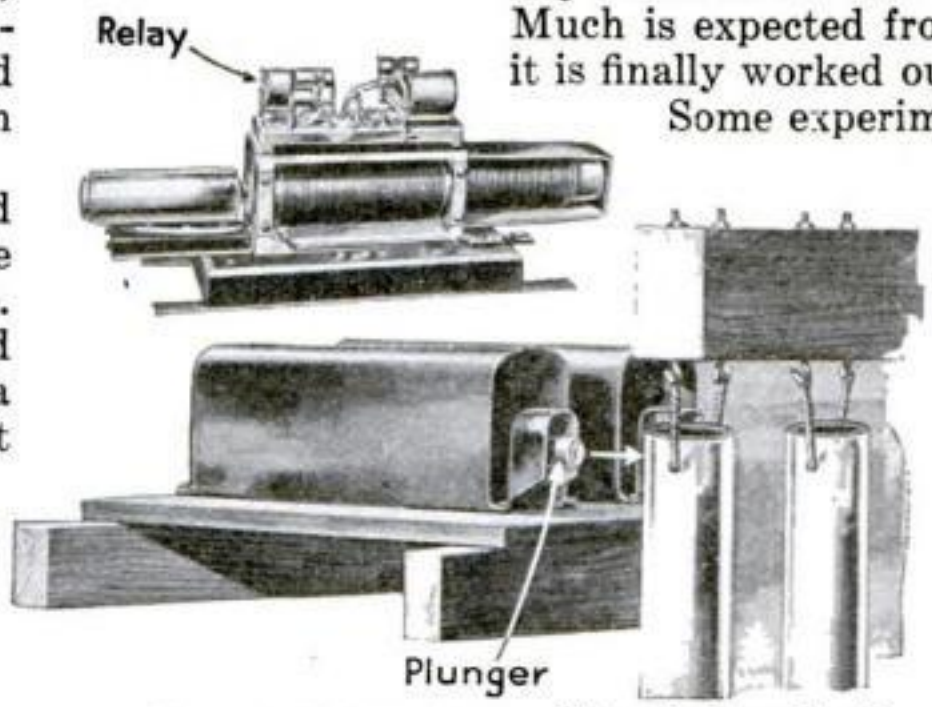
Ward Beam, a physical culture teacher, makes his pupils cross streams on a bridge which consists of two ropes, so that they may acquire "nerve"

The Tintinnabulation of the Electric Tubes—Playing Chimes by Electricity

EXPENSE is the principal reason why more church chimes aren't heard—expense and the difficulty of getting heavy bells up into a steeple. A Chicago company, however, is manufacturing chimes made up of heavy tubes instead of the usual bells. A whole set of fifteen or twenty may be stowed away in a small space and erected with comparative ease. Tube chimes may be tuned more closely than bells.

Instead of the customary ropes which actuate hammers, the tube chimes are played by electromagnets controlled from a keyboard. The plungers, forming part of the electromagnets, strike their respective tubes sharp and sudden blows when energized.

The keyboard used is about the size of a suitcase. It can be located anywhere inside a church, even next to the pipe-organ keyboard if desired. The keyboard belonging to the chimes does not carry power currents, relays being interposed to perform this operation.



The keyboard of the tube chimes may be placed beside that of the church pipe-organ

U. S. Government Tested Much War Machinery in 1917

ACCORDING to an annual report just issued, the U. S. Army's Board of Ordnance and Fortification has experimented with a number of interesting machines during the past year.

For instance, the production and trying out of a self-propelled, oil-electric, armored railway car was commenced. Tests are under way of the Hammond radio-dynamic system of torpedo control. For the purchase of this system, if it proves satisfactory to a Board of three Army and three Navy officers, and the President, Congress some time ago appropriated $750,000, and an additional $417,000 to buy material for and make a sample unit. Much is expected from the system when it is finally worked out.

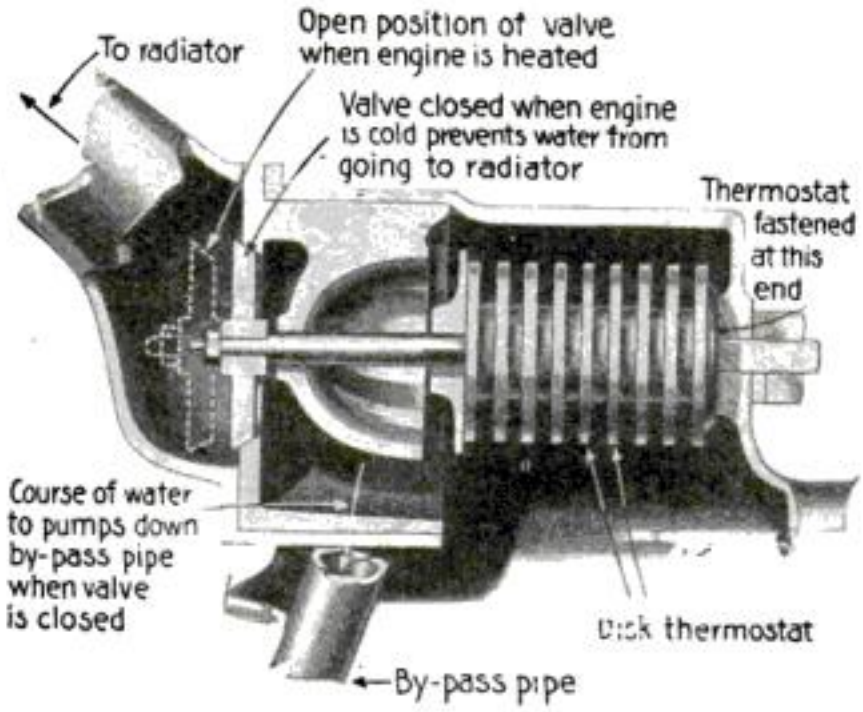
Some experimental gun emplacements have been built and put through many tests. Portable searchlights for the field artillery have been devised. Flares and star bombs for trench use were decided upon. Pontoon boats are to be propelled by the outboard type of motor in as many cases as possible. This motor is already familiar through use on ordinary rowboats. Radio sets, cameras, turntables for siege artillery, illuminated compasses and many other new conveniences for military use are being developed. Trinitrotoluol, the powerful explosive, gave demonstrations of its powers at the Sandy Hook proving ground.

Several submarine detectors are shortly to be tried out on actual submarines. Our own U-boats will be used for this purpose and a wide range of experiments and tests will be made. Investigators have been working on the subject all summer, and it is hoped to turn out perfected machines shortly.

Keep Your Engine Efficient

This new thermostat cuts off the radiator when it cools the water too much

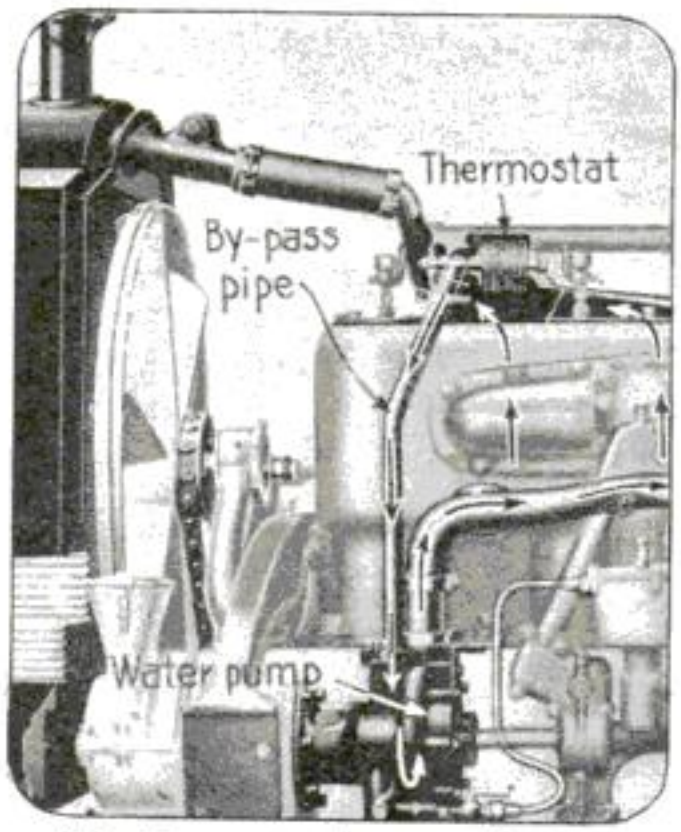
ONE of the large makers of motor trucks in this country equips all of his truck engines with thermostats (thermometers that control the temperature of hot fluids) in the water line to control the heat of the water in the cylinder jacket, so that at all times the engine is operating at its most efficient temperature. This condition is especially important in cold weather, when it is difficult to start the engine.



The thermostat keeps the engine always running at its most efficient temperature

The thermostat is controlled entirely by the temperature of the water in the cylinder jacket and operates to by-pass some of the water back to the pump, instead of allowing it to be cooled in passing through the radiator in the usual manner. This is only done when the water is cold, as when starting, and is equivalent to using the same water over and over again without sending it through the radiator to be cooled. As soon as the temperature rises, the thermostat automatically closes the by-pass pipe and allows all of the water to go through the radiator so that the engine will not eventually overheat.

The thermostat consists of a series of ten metal disks mounted on a shaft fixed at its rear end to the water system casing on the top of the cylinder block. The other end of the shaft carries a valve which seats on a special cage inside of the water space. This cage is open at the end nearest the disks and is provided with an opening leading to a by-pass pipe direct to the engine water pump as shown. When the cooling water is cold, the disks are contracted and the valve in the end leading to the radiator is closed, thereby permitting the water to flow down the by-pass pipe into the pump and be circulated without being cooled by passing through the radiator. As the water heats up, however, the disks expand and the end of the shaft is forced forward, opening the valve leading to the radiator and at the same time closing the opening to the by-pass. When this occurs, the water passes through the radiator in the regular manner. As the temperature of the cooling water varies, the thermostat alternately opens and closes the by-pass so that the temperature is kept at its most efficient point.



The thermostat is controlled entirely by the temperature of the water in the cylinder jacket

No more need the electric starter whir and whir around in an attempt to start a frozen engine. With this contrivance, enough warm water should remain in the engine jacket to make starting a relatively easy operation.

A Novel Tea-Table Made From a Mill Stone

SINCE farmers now rarely bring their grain to a small local mill to be ground, the old millstones have gradually settled to the bottom of the rubbish heap. Many have been broken up, but the lovers of antiques are now rescuing the remaining ones.

In the illustration is shown an old stone found in a New Hampshire mill. It is now used as the tea-table. Remembering the Biblical warning that "on whom it shall fall it will grind into powder," it is set on a stand of rocks which have been firmly cemented together.

Benches or individual seats of stone are appropriate for use with such a table.

An old millstone used as a tea-table. The stand is made of rocks cemented together

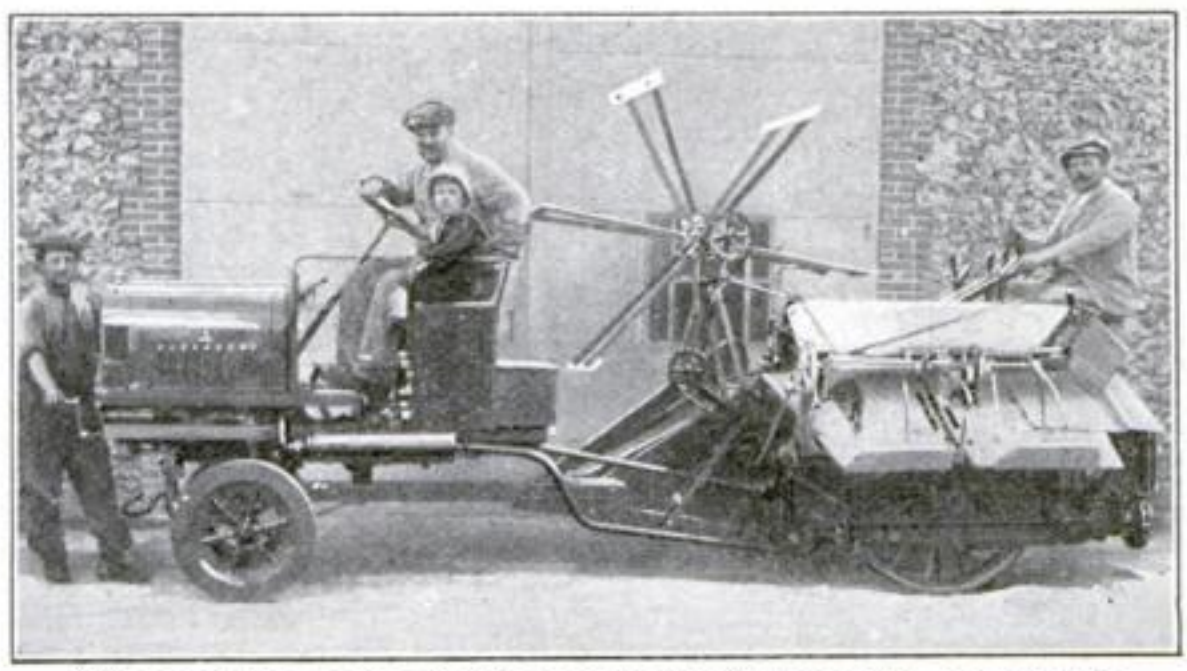
A French Inventor Improves the American Harvester

ERNEST BONNET of Nonancourt, France, has made important improvements in an automotor harvesting machine, which facilitate cleaning and moving the machine from one place to another. The working parts of this new harvester may be completely uncoupled. The front tractor is attached to a trailer which comprises a harvester, combined with connections for transmitting rotary motion from the motor to the trailer and power-control mechanism on the trailer.

Power is so transmitted that the driver can unclutch the driving wheels for halting the vehicle, without stopping the operation of the working parts. The reverse effect can be obtained, and the driving wheels can be made to carry the vehicle forward without setting the other mechanism operating.

The traction wheels are hung on vertical pivots with a bridge connecting them. This bridge carries a differential gear. A divided axle communicates movement from the differential to the traction wheel. Universal joints are provided coinciding with the vertical pivots of the wheel. Transmitting mechanism for communicating rotation from the motor to the differential gear completes the combination.

Will machines, such as this, shortly be used on our great Mid-western farming lands? Assuredly tractors, in one form or another are to work great changes in our agricultural methods in the very near future.



The working parts of this new harvester may be completely uncoupled. The engine in front drives the whole mechanism

Your Out-door Shooting

Throwing clay birds as a boy "scales" flat stones adds new zest to trap shooting

CONSIDER the small boy who finds a nice, smooth, flat rock. If the chances are not more than even for breaking a window—and getting caught—he curves index finger around one side of its periphery and lays thumb against the other. Then with a long swing of his arm, keeping the rock horizontal, he sends it scaling flatways through the air. In its long, spinning, steady flight it travels more smoothly and farther than any round rock.

The Darton hand trap is simple to use. It is speedy; shooters must be alert

Since the saucer-like clay bird displaced the round and costly glass ball as an artificial target for the shotgun, the throwing machinery or trap has closely followed the lines of the small boy's hand and arm. The sole exception is the sort in which the bird is laid on a flat, steel plate, to be swept off by the swing across it of a rubber-faced steel arm.

The Darton hand-trap, shown in the photographs, is the simplest of all the devices yet put out for the purpose of sending the flat, clay saucer sailing on its spinning course through the air. It approximates uncannily the two fingers and the arm of the original flat, disk-throwing machine operated by the small boy.

The clay bird is grasped by the extended metal fingers

The bird is held between a thumb and forefinger made of heavy wire, set at the end of a slightly flexible, wooden handle, with grip shaped for the hand. One finger is longer than the other. In one form, the two parallel wires forming each finger, continue parallel, and the saucer which is a 4¼-inch hollow, clay disk, is pushed in between the fingers from the front—a "muzzle-loader," as the inventor terms it. In the other form, the top wire of each pair is bent outward so that the saucer can be dropped into the grasp of the fingers from the rear. This obviates the necessity of pressing the bird home against the resistance of the fingers.

The two, wire sidebars to each finger are so spaced as to grip the edge of the target firmly, and the two fingers terminate at the rear end in a metal socket screwed to the wooden handle. When the bird is placed horizontally in the fingers, and the handle is given a powerful full-arm swing, with a snap at the finish of the swing, the bird is thrown out of the grip of the fingers by the centrifugal motion. The longer finger yields to the pressure, letting the bird slip out of the grip and roll along this finger, giving it the spinning motion essential to steady and long flight of a flat object.

The fingers are considerably longer than the portion necessary to grip the target, affording a track along which the bird rolls when driven out by the centrifugal motion, and when a spin is imparted.

For the lover of a solitary game in shooting, the inventor adds a stout elastic

loop to the handle of the trap, by which it may be hung across the shoulders. Then he holds gun in left hand, swings mightily with the right, holding the trap, drops the trap at the end of the swing, grasps the fowling piece and "has at" the flying bird he has just thrown. As the bird leaves any of these traps with the speed of about 150 feet a second, even though it falls off rapidly, the shooter has to hustle to get into action before it is out of range.

Two other traps are in use for throwing the birds by "hand." One of them, the Ping Pong, is similar to the Darton, save that the bird is held in the regular steel, rubber-tipped fingers of the larger variety, bolted to a wooden handle. This takes more power than anyone but a full-grown man can develop. The other is operated by a powerful spiral spring which swings the throwing arm like the big set position traps, when the finger releases the trigger holding it. This requires a little effort to set, and is not entirely safe in the hands of the inexperienced because of the great force with which the spiral spring throws around the arm and the fingers that hold the bird.

So is field practise made available anywhere for the seasoned lover of the scattergun.

The bird can leave one of these hand-traps at a velocity of 150 feet per second

This hand-trap has a powerful spring. It should not be operated by the inexperienced, as it can deliver a terrific blow

How to Waterproof Your Boots

TALLOW has been used a great deal for waterproofing boots. But authorities on the subject of leather say that tallow is not the best thing to use because it contains a high percentage of fatty acid which is bad for leather.

Any good, heavy grease will make leather boots waterproof, if the leather is thoroughly soaked in it. One of the best substances to use is a belt preservative. The most important point in waterproofing boots is to use something that will fill the small openings and stitch holes. Belt preservative will best accomplish this result.

Boots should be well washed before being treated. They must be warmed, but not allowed to get too hot. Leather will stand no more heat than will your hand. The preservative is then heated and painted on the warm boots. They are kept warm until the oil has penetrated the pores of the leather. This process may be repeated several times, care being taken to work the preservative well in around the stitches. Boots cannot be polished after being waterproofed because the leather is left much too soft and porous.

An Electric Lantern Which Will Stand Rough Use

AN electric lantern specially constructed to withstand hard knocks and rough handling is shown in the accompanying illustration. The frame is made almost entirely of aluminum, and the bulb is set far back against a large reflector so that it is well protected. Two dry cells furnish the current for a brilliant light. A large strap with hooks is provided so that the lantern may be conveniently carried by suspending it from the shoulders.

This handy lantern for camping uses is constructed to withstand unusually hard knocks

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Heating Low-Grade Gasoline with Exhaust Gases

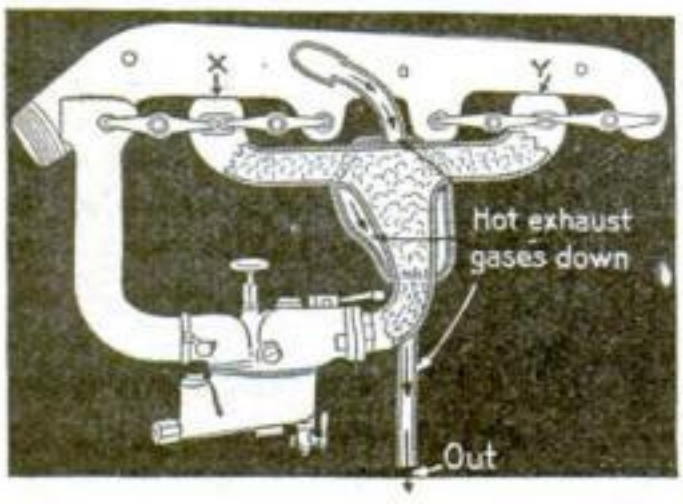
ONE of the simplest of the many heating devices to aid in more thoroughly vaporizing the present low-grade fuel used in automobiles, consists of two ham-shaped castings which are bolted together over the Y-shaped portion of the intake manifold in such a manner as to leave a small space between the manifold and the exhaust. This intervening space is filled with hot exhaust gases from the engine by means of a flexible metal tube tapped into the exhaust manifold at the top, and then exhausted down below the bottom of the engine-pan by means of a similar piece of flexible tube tapped into the bottom of one of the castings.

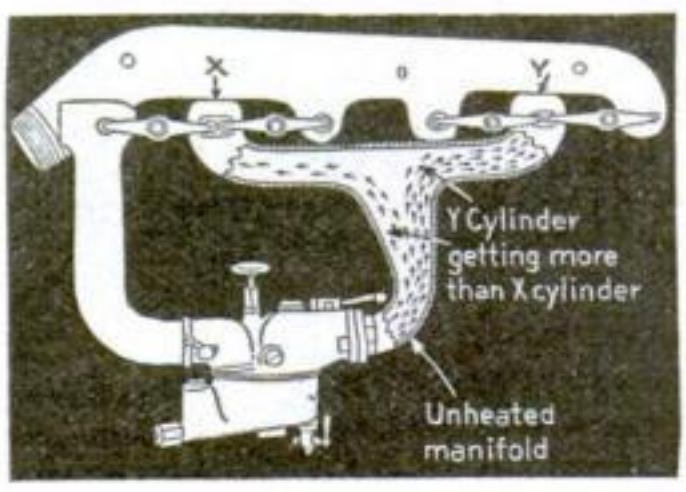
In passing through the space between the castings and the manifold *Y*, the exhaust gases heat the *Y*. The incoming fuel is raised to such a high temperature that it is broken up into very minute particles which are entirely consumed by the cylinder explosion.

The fuel so heated has then no tendency to condense on the manifold walls, which happens when the walls are cold. Instead, it diffuses itself equally between both arms of the *Y*, so that all four cylinders receive almost exactly the same amount of fuel, an end much to be desired.

Yawning Fishes. Evidently They Have Brains Enough to be Bored

DID you ever see a fish yawn? Mr. Richard Elmhirst, an English biologist, tells us that yawning is a common habit of cod, saithe, cobbler, plaice and various other kinds of fish. From his description the piscatorial yawn is very much like the human yawn, except that it is done under water. He says: "From numerous observations I am led to think that this action of fishes is a real yawn, and serves the true physiological purpose of a yawn; that is, flushing the brain with blood during periods of sluggishness. The conditions conducive to yawning are a slight increase in temperature, and, I suppose, the accompanying diminution of oxygen."



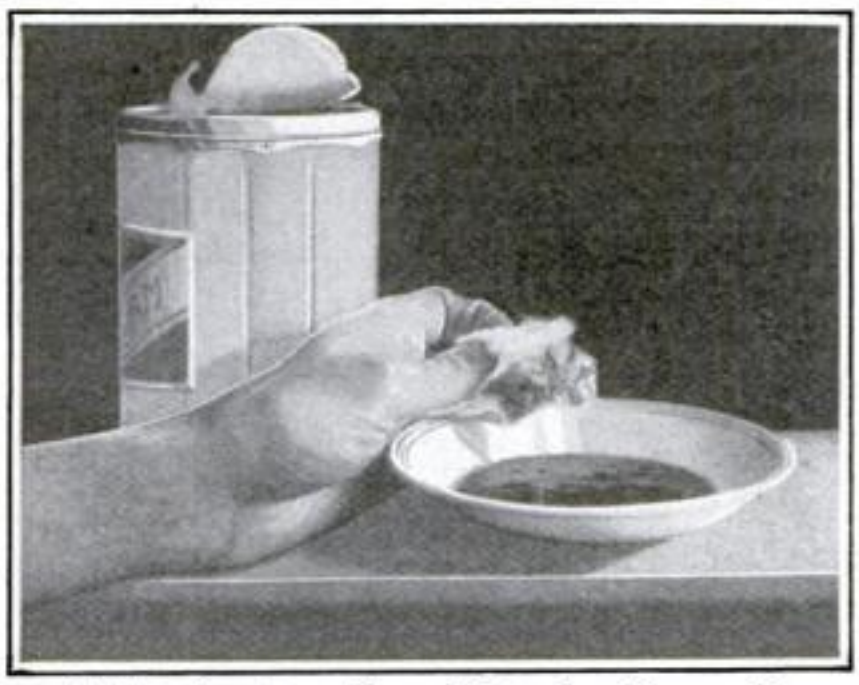


At left: Piping exhaust gases through casting surrounding intake manifold vaporizes low-grade fuels thoroughly. At right: Uneven gas-distribution as ordinarily encountered

FOR PRACTICAL WORKERS

Using a Piece of Wool to Detect Dye in Jam

SOME of the jam sold at the present time is dyed to give it an attractive color. Happily, it is easy to find out whether or not the jam has been treated



A bit of cotton dipped into dyed jam will retain the color through many washings

in this way. The first step is to mix a little of the suspected article with some water, then dip into it a piece of clean cotton wool. If the jam has been artificially colored, the stain on the wool will be very difficult to wash out. On the other hand, when the jam is pure, the stain can be rinsed away very easily.

Rubber Roofing Used for Packing in Steam Joints

IN case of emergency—and in the regular course of repairs for that matter—ordinary rubber roofing makes an excellent packing for steam joints. As a gasket between flanges on a steam line, for cylinder head, or for steam chest work, it lasts just as well as regular packing and shows no more of a tendency to blow out. Moreover it is a great deal cheaper.

Deodorizing Naphthaline for Medicinal Purposes

NAPHTHALINE has such a disagreeable odor that its use in medicine and surgery is considerably retarded, and it has been found out by experience that the mixture of camphor and various other deodorants with it produces only a temporary benefit. Mixing the naphthaline with some benzoin and subliming the mixture, frees the sublimate of naphthaline from the tarry smell. Moreover, the naphthaline is given a pleasant odor. This is not the case when it is simply mixed with tincture of benzoin or benzoic acid.

Trick of Brushing Ten-Cent Piece from the Palm

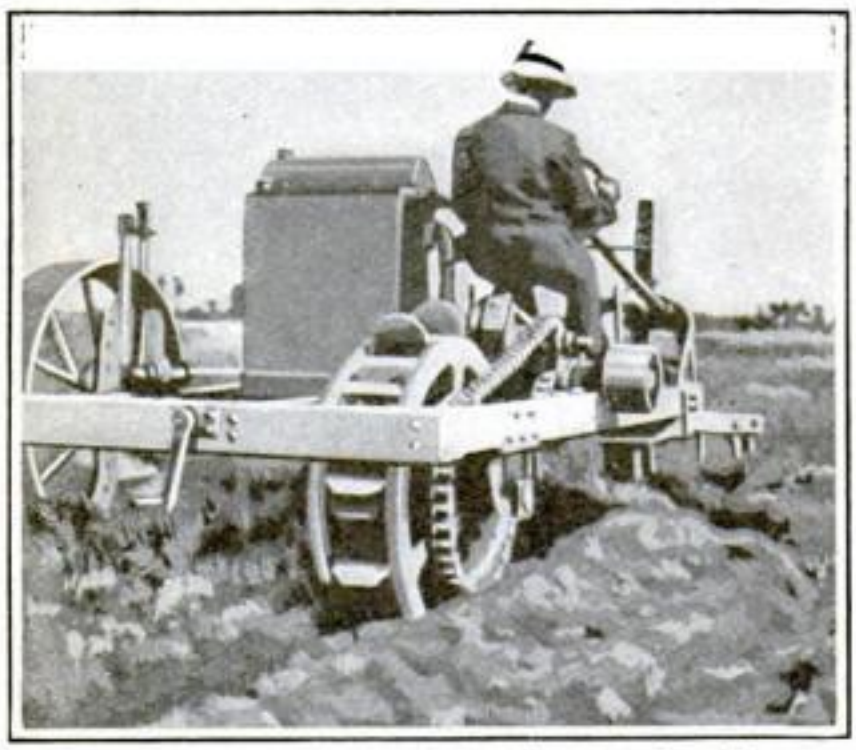
STRETCH out your hand and place a dime in the center of your palm Give your chum a whisk broom and ask him to brush off the dime. He will probably laugh and ask "What's the idea?" But let him try it. He can brush for half an hour without removing the coin. A dime cannot be brushed from the center of the palm with a whisk broom unless it is "dug out" with a corner, which would not be fair play. Try it for yourself first and see—then try it with your friends. If anyone wishes to examine the dime after the stunt, tell him that even the dime says the joke is on him. To prove this, turn the coin over to show the printed words: ONE DIME. Cover up the E and the Di. The remaining letters spell "ON ME."

The coin cannot be swept out

Positive Traction Wheel for a Motor Plow

WHEN an agricultural tractor is used for pulling plows in tenacious soil, it is necessary to augment the traction obtained by the normal adhesion of the loaded traction members and the ground with the added impulsive force secured by cleats or spurs that dig into the soil. A novel form of traction member used on a motor-driven plow of Italian design is here illustrated. It provides positive traction and is at the same time relatively free-rolling because the blade members that dig into the ground enter and leave the earth in an almost straight line. The ordinary form of fixed spur or cleat must strike the ground at an angle and push the earth back out of the way as the wheel rolls forward. This calls for the expenditure of power and of course reduces the efficiency of transmission. To have the spurs engage the ground with an almost direct thrust and leave it with a direct upward pull is a very desirable end to attain because there is a minimum displacement of earth with its attendant loss of energy.

The spurs enter and leave the ground vertically



There is no power lost in lifting dead weight with the grippers as they work vertically

The mechanism by which the traction-augmenting blades are made to engage the ground with minimum loss of power is very simple and the principle involved may be clearly grasped by a study of the diagram. The spurs are in the form of drop-forged steel bell-cranks, swinging on fulcrum-pins carried between the two halves or side plates comprising the wheel. The actuating cam is attached to the fixed axle on which the wheel revolves. An eccentric strap having a plurality of connecting rods extending to the spurs, surrounds the cam or eccentric, and as the wheel revolves the spurs are rocked back and forth on their supporting pins, the motion being so proportioned that when the traction blade is about to engage the ground it is approximately perpendicular. Some such form of positive traction member is almost essential because the plows are mounted at the front and are pushed, not pulled. The traction-wheel, being on the same side as the plows, must necessarily work in the loose, soft ground of the furrows.—VICTOR W. PAGÉ.

Things To Be Remembered When Washing an Automobile

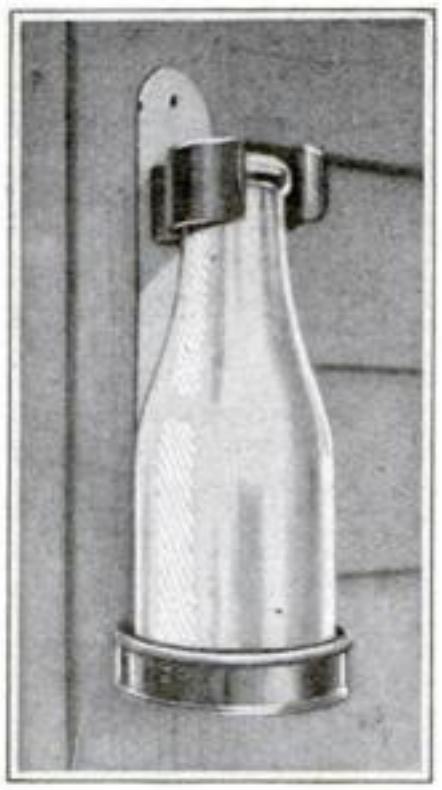
NEVER try to wash the car out in the cold. Take it in where it is moderately warm; then use clear, cold water. The cold water will help to harden the varnish on a new car, thereby preventing abrasion. If you use any soap at all, use only a limited amount, as free acid or alkali tends to soften the finish. Soak caked mud thoroughly with a small stream of water until the mud runs off with the fluid. Don't rub the mud off. If it has frozen to the finish, keep on applying cold water until it runs away. Never use hot water. In drying the car, avoid using a chamois that contains any sand or grit. If polish is necessary, use a good grade, then rub off the surplus.

Never allow a car of fine finish to stand in a barn or stable where animals are kept. The ammonia of the manure will check and ruin the gloss.

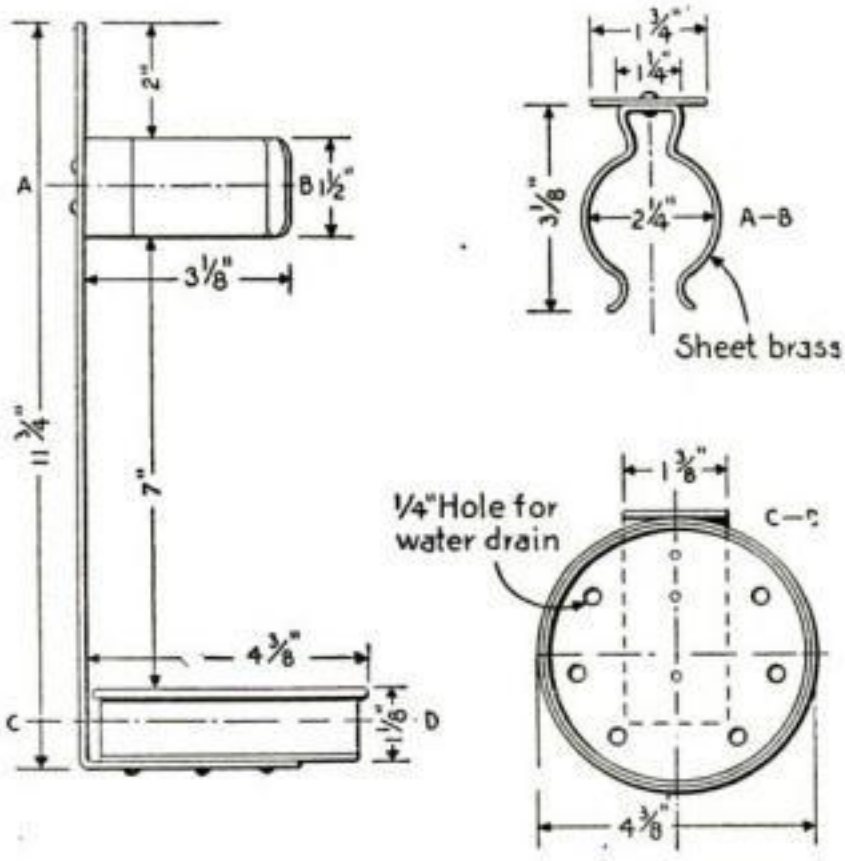
Don't keep the garage too hot. This caution applies to what is probably the greatest enemy of the fine body finish. In an overheated garage, the body of the car gradually expands; then if the car is suddenly exposed to extreme cold, the result is plain. The sudden contraction in cooling causes the paint to check.

A Convenient Metal Holder for Milk Bottles

JUST where the milk bottles go and what becomes of them is difficult for some housewives to determine. The illustrations show a very handy little receptacle for the bottles. It can easily be made in any home workshop. The base is manufactured out of an old coffee can cover, the top or spring catch portion being simply an old piece of sheet brass, moulded or formed over a round bar. When the old bottle is empty, it is slipped into the device and the milkman on his round replaces it with a full one. The holder can be placed anywhere on the side of the house, or near the door, low enough so that it can be easily reached, yet high enough to protect the bottles from accidental upsetting or from being knocked out.—F. W. BENTLEY, JR.



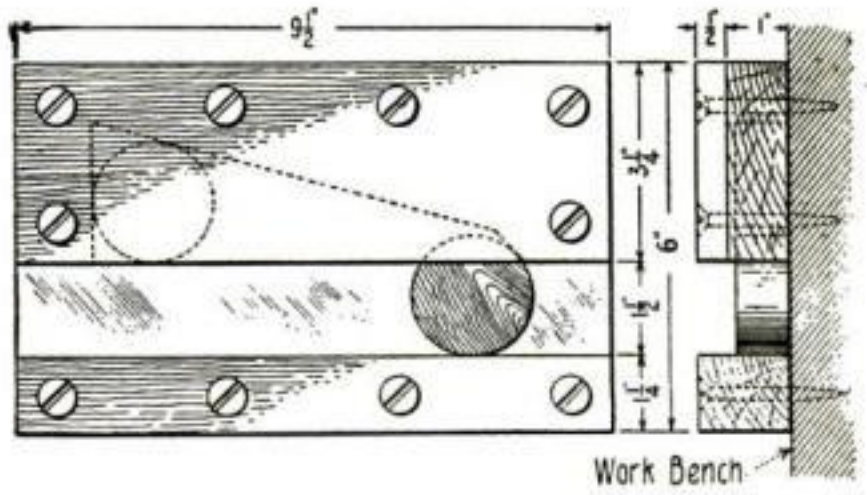
The bottle of milk is easily set in holder



The sheet metal parts are made the correct size to hold an ordinary quart bottle

A Work Bench Clamp to Hold Boards for Planing

THIS very handy clamp or vise is easily made of oak or other suitable, hard wood. It consists of three pieces and a disk. The pieces are 9½ in. long; one is 1¼ in. wide and 1½ in. thick; the base of the other part is 3½ in. wide and 1 in. thick with a cap of the same width and ½ in. thick. The disk is 2 in. in diameter and slightly under 1 in. in thickness. A wedge-shaped notch is cut in the piece that is 1 in. thick, so that the larger part admits the full size of the disk, the smaller part sloping down almost to a point. The pieces are fastened to the bench top as shown, with a space between them of 1¼ in., and with the disk in the notch.



The disk rolls on the sloping part of the groove and clamps the board by pressure

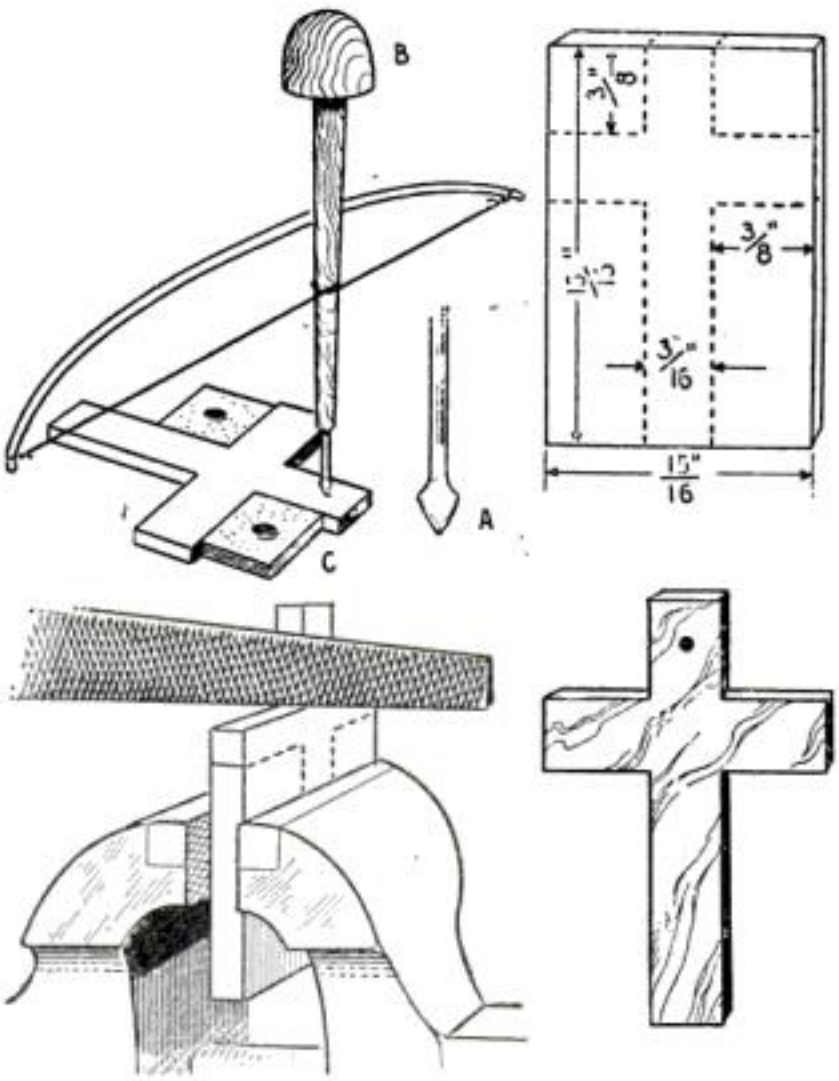
It is apparent that when a board is placed edgewise in the open space, while the disk is in the larger opening of the notch, it will be free, but upon pushing it forward the disk will roll against the sloping part, and wedge or clamp it. The more pressure applied, the tighter will be the grip on the board. When it is pulled back, the action is reversed and the board is easily withdrawn.—ROBERT HANLEY.

Solution for Cleaning Polished Brass Quickly

THE following solution will clean brass faucets very quickly, without injury to the hands or the metal. Put 1½ oz. of alum in one pint of boiling water, and rub the solution on the brass surface with a cloth. The stains, as well as the tarnish, are quickly removed. The solution is inexpensive and easily made.

How to Make a Watch-Charm of Marble, Agate or Granite

A SMALL cross made of marble, agate or granite makes an attractive watch-charm. The process of shaping it



Dimensions of the cross to be made; also how it is to be drilled and cut from marble

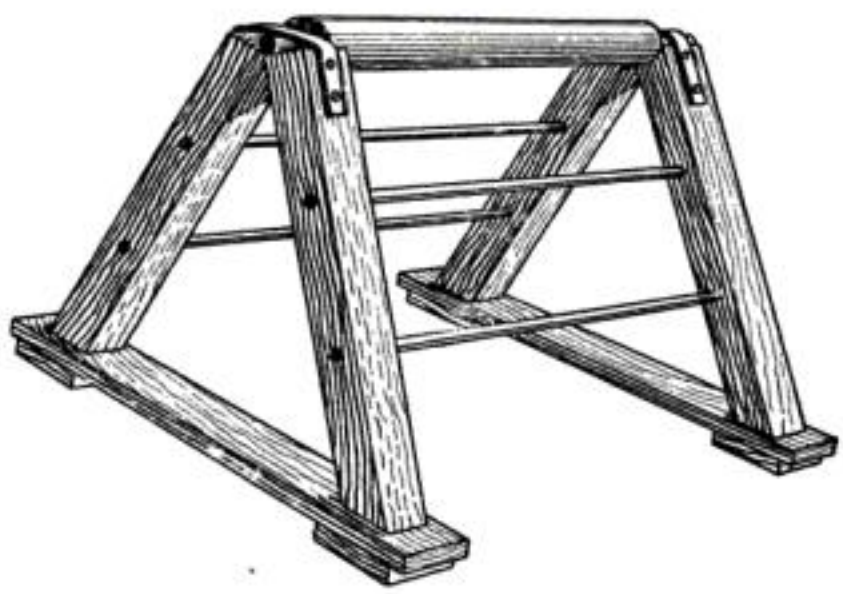
is very simple. It can be done with a file. First flatten the piece from which it is to be cut, by rubbing it on a sand stone; then mark the pattern on the sanded side with a file point. Next file to your lines with a flat-faced file, holding the piece in a vise. Bore a hole in the upper portion of the finished cross by means of a fiddle drill. A piece of a darning needle flattened and pointed as at *A* serves as a bit. The butt end is also flattened, so it will not turn, and imbedded in the end of a hard wood stick. A small, loose-fitting metal cap, *B*, makes a hand rest and permits the shank to turn. The bow is a hardwood stick. Its ends are joined by means of a stout string. With the hand on *B*, the bow is pushed back and forth, and the metal point will soon drill through the stone. Keep it wet as you drill. Leather squares, *C*, tacked to the bench, hold the piece of stone firmly. The charm is polished by rubbing with fine-grained marble and finally given an oil rubbing with a piece of felt. Any amateur may attempt this dainty piece of work in all confidence. Ordinary carefulness is the chief requirement that makes for success in making this attractive watch-charm.—JOHN L. DOUGHENY.

A Small Steam Engine Used as an Air Compressor

IN a small machine-shop some metal tanks were ready to ship when the order came to test them under 60 lb. air pressure. There was no air compressor at hand and no time or money to get one. But the tanks were all tested that day just the same. There was in the shop a 6-horsepower steam engine undergoing repairs. This engine was belted up to the line shaft with a piece of pipe between the steam chest and one of the tanks. A gate valve was put in this line and a pressure gage was attached to the tank. Then the engine was started, and air was pumped into the tank until the gage registered the 60 lb. In this way, each tank was thoroughly tested at no great cost.

A Portable Board Roller for Circular Saw Feed

THE illustration shows how a wheelwright used a discarded wringer-roller in the construction of a board slide or rest, used in conjunction with a circular saw. The rubber of the roller evidently



Rubber roller from a wringer used on a special horse to make a board roller

exercised brake enough on the boards to prevent sudden spurts during the process of sawing.—JAMES M. KANE.

Disappearing Clothes Rack for the Closet

THE materials necessary for the disappearing rack are: 2 single-sheave pulleys, one double-sheave pulley, 3 screw hooks, 15 to 20 ft. of light rope, and

Arrangement of pulleys in a closet for hoisting a pole from which clothes hang

a thin pole about 4 ft. long (a broom stick will answer very well). The pole is fastened by two of the screw hooks placed in the ceiling, about 3 ft. apart. The double-pulley can be fastened near the ceiling at a convenient end of the closet. This pulley is to act as a guide for the ropes. The stick is supported at each end by a rope; the other end of the rope passes over one of the single pulleys, then over the double pulley and down to a convenient distance for hoisting and lowering the rack. In order to prevent the rack from tipping or tilting to one end, the ropes should be knotted together at such a place that when the rack is lowered to the right height, the knot will just strike the double pulley. In order to hold the rack in place, the ropes may be wound around two nails placed below the double pulley.—F. W. BUERSTATTE.

A Combination Straight and Folding Step Ladder

TO make a ladder that can be used either as a straight ladder or as a step ladder, the following material is required:

2 pieces of 1 by 3-in. straight-grained wood, without knots, 6 ft. long.
6 pieces of the same 18-in. long.
2 pieces of the same 5 ft. long.
3 pieces of the same 16-in. long.
2 pieces of stout broomhandle 18-in. long.
A quantity of 8 or 10d nails.

About ½ in. from one end of each of the four long pieces bore a hole, through which a broomhandle will pass fairly easily, and 1 ft. back from this hole bore another one, as shown in the illustration.

This folding ladder is in two parts

Lay the two longest pieces with edges up, and nail on the six 18-in. rungs, beginning at the end nearest the holes and placing them about a ft. apart. Do the same with the two shorter pieces, but in this case begin the rungs about 2 ft. from the ends with the holes in them.

Next place the short ladder within the long ladder so that the holes are in line. Slide one of the pieces of broomhandle through these holes to form a pivot. Fasten the pivot to the large ladder with a small nail to prevent it from slipping out, then allow the small ladder to swing free.

With the addition of a short length of rope or chain placed between the two sections to prevent their spreading, the step-ladder is ready for use.

To convert it into a straight ladder all that is needed is to detach the stop-chain, swing the short section up until it is in line with the long section, and slide the other piece of broomhandle through the holes.

A Rustic Seat Made from an Old Tree Stump

IT was merely as a matter of convenience that the largest limb of a tree which was felled, was sawed off nearer the

The shape of this tree made a very simple task to construct a seat from its stump

ground than were the two smaller branches. However, this at once suggested a seat, which was very easily made. A piece of board was placed on the large stump and a simple back made of two cross poles with vertical slats nailed to them was fastened between the two smaller limbs. With the bark removed and the surface coated with a dull green paint the seat harmonizes with the surroundings.

Admitting Air to a Pullman Car Without Creating a Draft

WHEN one is traveling in a stuffy, crowded train, especially in cold weather, when all the windows are closed, the jouncing of the cars over the rails, coupled with the close atmosphere, often produced a feeling similar to sea-sickness.

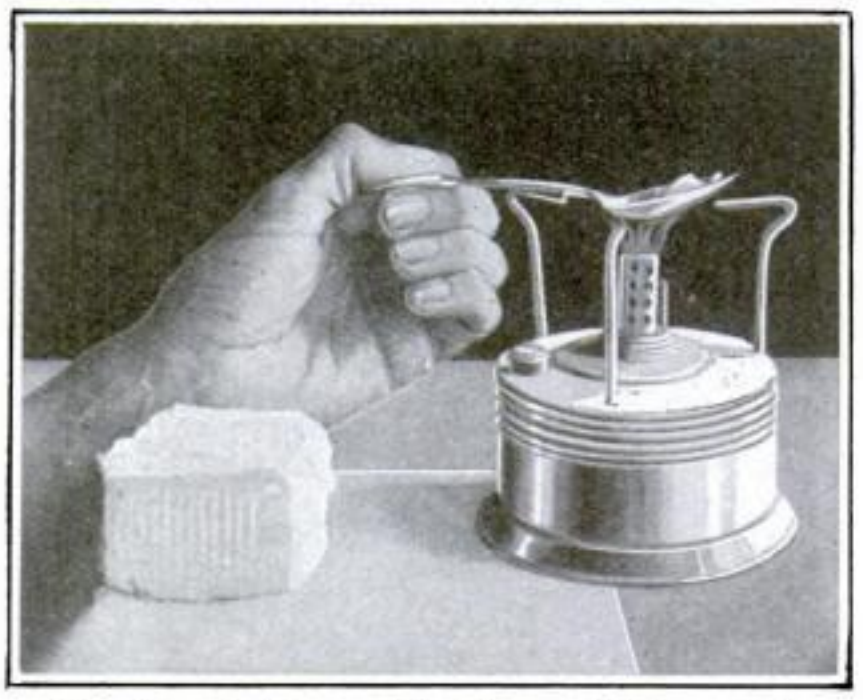
Fresh air relieves this nausea, but the windows of a railway coach are so situated that when the train is moving fast, the pressure of air is so great that it rushes past the person for whom it is intended, and in cold weather causes the passengers directly behind much discomfort. To remedy this is a simple matter.

Take a newspaper, fold it once and roll it into the shape of a cone. Place the large end of the cone outside the window which is opened about 4 in. The small end is held very close to the nostrils, not at right angles to the window but at an angle, somewhat forward, at which the air can be taken in. The speed of the train causes the air that enters the large end of the cone to be carried directly to the nostrils, and as the window is only open from 3 to 4 in., very little draft is created.

If one finds that cinders are coming in through the cone, move the cone about 2 in. forward and place the hand at right angles to the face, close to the nose, on the side away from the window. In this way the air strikes the hand first and travels along the palm to the nostrils, while the cinders strike the hand and fall harmlessly to the floor.

A Test Which Tells You When Butter Is Not Butter

DO you know how to make a test to determine if you are buying real butter or a worked-up article such as a butter mixture or margarine? The test is an interesting one. Place a small lump of the material in an old spoon and hold this over a spirit stove or a gas burner. Watch how it boils. Real butter will boil quietly, making a large amount of froth. Margarine makes a great deal of noise, spluttering like a green

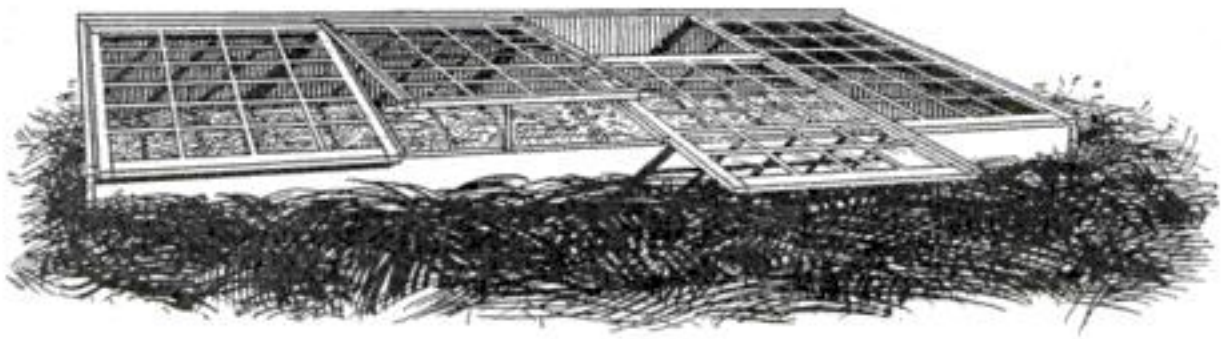


Genuine butter will always boil quietly while margarine will sputter and crackle

stick placed in the fire. This is a sure test by means of which you can find out whether or not you are really getting pure butter.

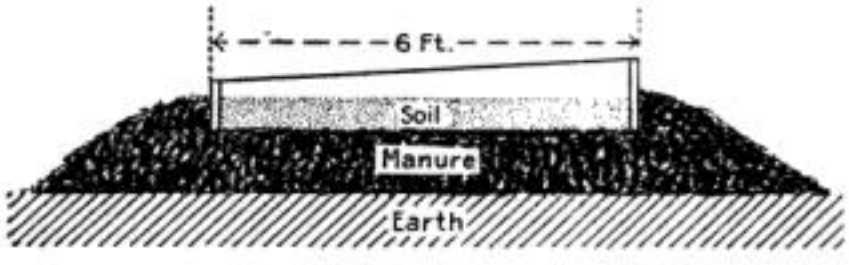
Hotbeds in Which Safely to Start Early Plants

IN the North, the most common method of starting early plants is by means of the hotbed. The hotbed consists of an inclosure covered with sash and supplied with some form of heat, usually fermenting stable manure, to keep the plants warm and in a growing condition. As a rule, the hotbed should not be placed within the garden inclosure, but near some frequently used path or building, where it can receive attention without interfering with other work. The hotbed should always face the south. The south side of a dwelling, a barn, a tight board fence, a hedge, or of anything affording a similar protection, furnishes a good location.



Typical hotbed made in the earth. It is framed to hold several sash for admitting the sun's rays and keeping out the cold at night

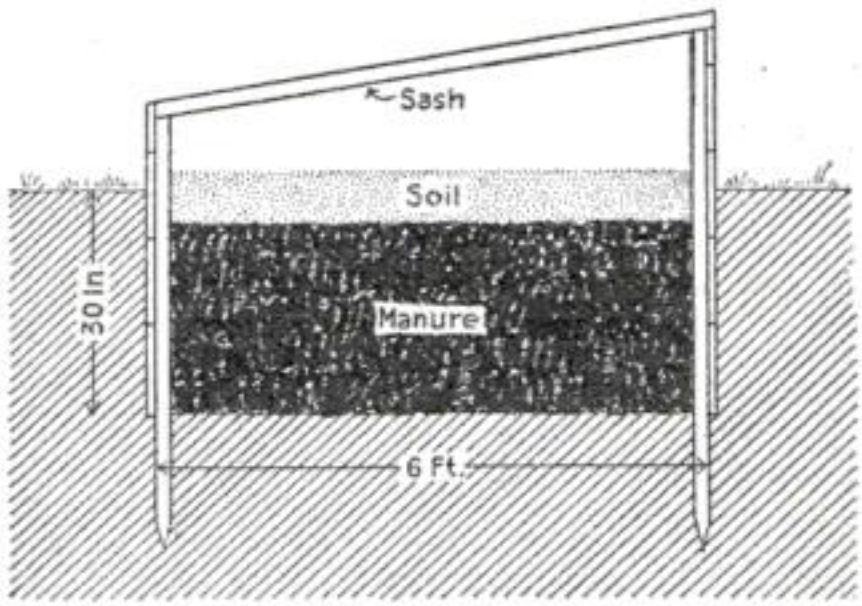
The Department of Agriculture instructs that in the North, the hotbed should be started in February, or early in March, in order that such plants as the tomato and early cabbage may be well grown before it is time to plant them in the open ground. There are two or three forms of hotbeds that are worthy of description. The plans suggested may be modified to suit local conditions.



Cross section of a temporary hotbed which is built entirely on the surface

A temporary hotbed, such as would ordinarily be employed on the farm, is easily constructed. Manure from the horse stable can be used as a means of furnishing the heat. Select a well-drained location, where the bed will be sheltered, shake out the manure into a broad, flat heap, and thoroughly compact it by tamping. When compacted, the manure heap should be 8 or 9 ft. wide, 18 to 24 in. deep and of any desired length, according to the number of sash to be employed. The manure for hotbed purposes should contain sufficient litter, such as leaves or straw, to prevent sogginess, and it should spring slightly when trodden upon.

After the manure has been properly tramped and leveled, the frames to support the sash are placed in position, facing toward the south. These frames are generally made to carry 4 standard hotbed sash. The front board should be from 4 to 6 in. lower than the back board so that

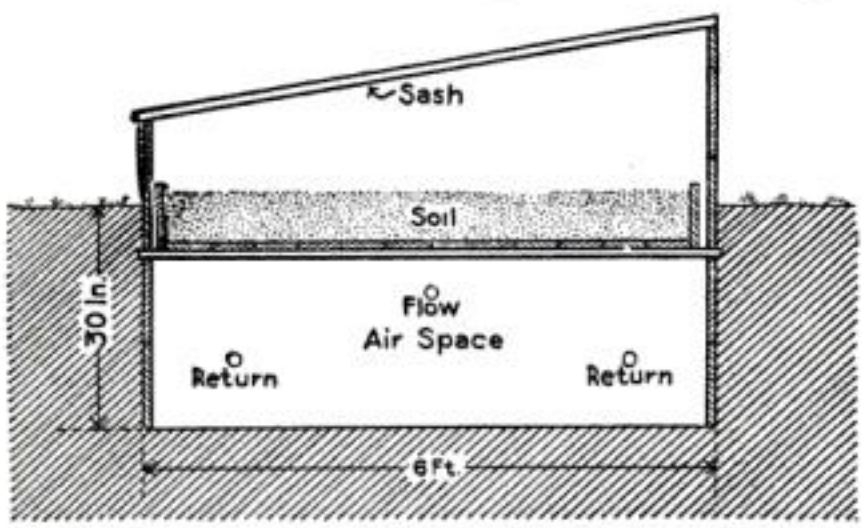


A cross section of a permanent hotbed with heating material and soil below the earth's surface and within walls made up of boards

water will drain from the glass. When the frame is in position upon the manure, the surface hotbed will appear as shown in the illustrations. The area inclosed by the glass should be covered with a good garden loam or with a specially prepared soil, to a depth of 3 to 5 in. Then the sash is put on and the bed is allowed to heat. At first, the temperature of the bed will run rather high, but no seeds should be planted until the soil temperature falls to 80 deg. F., which it will in about three days.

Hotbeds, having more or less permanence, may be so constructed that they

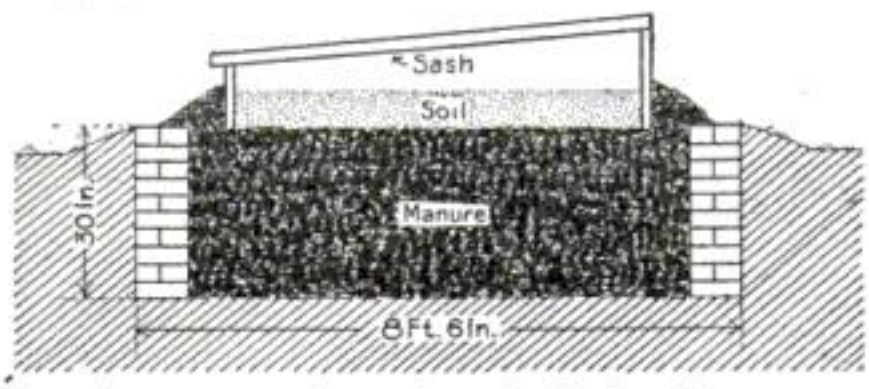
can be heated either with fermenting manure, a stove, a brick flue, or by means of radiating pipes, supplied with steam or hot water from a dwelling or other heating



Cross section of a hotbed having a lower chamber heated by steam pipes

plant. For a permanent hotbed in which fermenting manure is to supply the heat, a pit 24 to 30 in. in depth should be provided. The sides and ends of the pit may be supported by brick walls or by a lining of 2-in. plank held in place by stakes.

Standard hotbed sash are 3 ft. by 6 ft. in size, and are usually constructed of white pine or cypress. As a rule, hotbed sash can be purchased cheaper than they can be made locally, and they are on sale by seedmen and dealers in garden supplies. In the colder parts of the country, in addition to the glazed sash, either board shutters, straw mats, burlap, or old carpet will be required as a covering during cold nights. It is also desirable to have a supply of straw on hand to throw over



A cross section of a hotbed with an enlarged pit for the heating material

the bed in case of extremely cold weather.

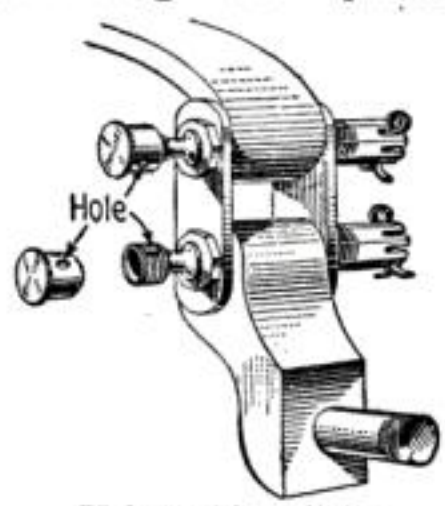
During bright days, the hotbed will heat very quickly from the sunshine on the glass and it will be necessary to ventilate it during the early morning by slightly raising the sash on the side away from the wind. Care should be taken, in ventilating, to protect the plants from a draft of cold air. Toward evening, the sash should be closed in order that the bed may become sufficiently warm before nightfall.

Hotbeds should be watered on bright days, and in the morning only. Watering in the evening or on cloudy days will have a tendency to chill the bed and to increase the danger from freezing. After watering, the bed should be well ventilated to dry the foliage of the plants and the surface of the soil, to prevent damage to the plants from damping-off fungus or mildew.

The construction of a cold frame is the same as that of temporary hotbeds, except that no manure or other heating material is provided. Cold frames are covered by means of ordinary hotbed sash, or cotton cloth may be substituted for the sash. In the North, the use of the cold frame is for hardening plants that have been started in the hotbed, preparatory to setting them in the garden. In the South, where the weather is not so severe, the cold frame is made to take the place of the hotbed in starting early plants. The same methods of handling recommended for a hotbed should apply to a cold frame. Thorough ventilation should always be maintained in any style of hotbed.

Properly Lubricating Automobile Spring Bolts

WHERE hard oil is used as a lubricant for automobile spring bolts, it sometimes dries in the small holes and grooves that feed it to the bearing surfaces, thus preventing the parts from being properly lubricated. This causes the bolts and spring eyes to wear out quickly. A way is illustrated whereby this condition may be remedied successfully by adopting oil cups for thin oil.



Using thin oil in hard grease cups

Drill a hole large enough to allow the oil to be poured in through the cap and threaded portion of the bolt as shown in the illustration. Then turn the cap half way around, thus completely closing the hole.—ODIS REYNOLDS.

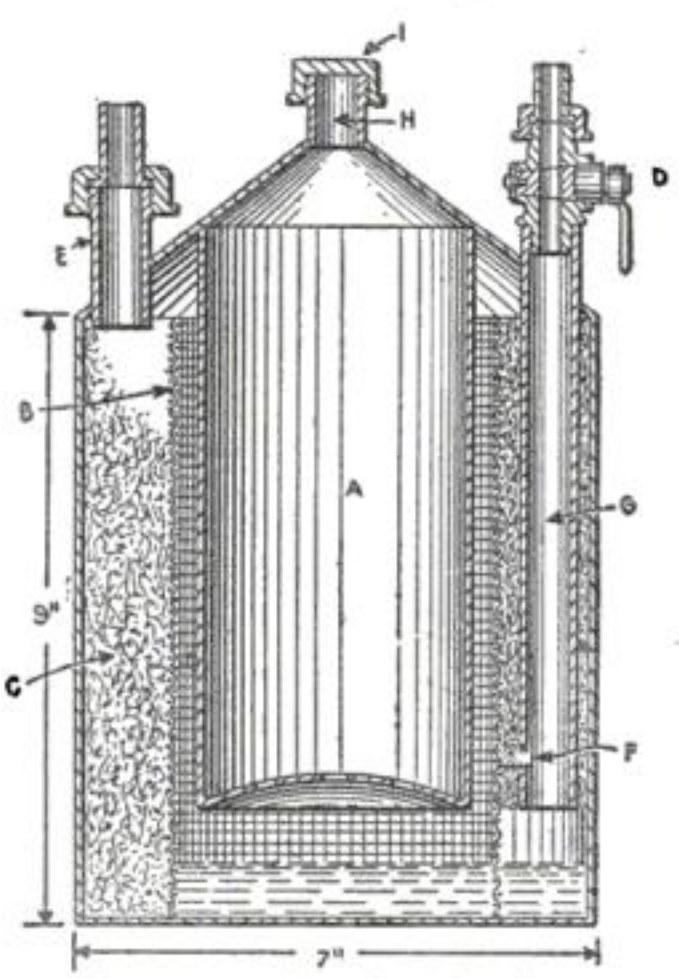
How to Economize in the Use of Coal Gas

OWING to the increase in the consumption of coal gas both for cooking and lighting, any means of reducing the cost of it will be welcomed by the consumer. The illuminating power of gas by the use of the common tip burner is not considered so much as its heating properties. Whether it is the incandescent mantle or the gas mixed with air in the atmospheric burner of the gas stove, the effect is due to the heat produced by the combustion of the combined gas and air.

It is upon this heating effect that the intense luminousness of the mantle depends. With the use of the apparatus shown in the illustrations both the luminousness of the common burner and the heating effect may be increased considerably by mixing a volatile hydrocarbon with the gas after it leaves the meter and before it is burned. Any free carbonic oxide contained in the gas will combine with a rich hydrocarbon, carry it to the point of consumption and there develop a remarkable degree of heat and light. Moreover, the cost will be very much lower than if simple coal gas or a mixture of coal gas and what is known as water gas is employed.

When either coal gas, or a combination of coal and water gas, or water gas charged with hydrocarbon is passed through a carbureter or economizer, as described, a quantity of the hydrocarbon with which it is charged will be carried off in vapor form, thus increasing both the heating and lighting effect wherever it may be consumed. This carbureter is not at all expensive to construct, as it is mainly constructed of tin plate with a few ordinary gas fittings which any good tinsmith or plumber can make.

The illustration clearly shows the apparatus in section. This apparatus has been well tested. The hydrocarbon used in charging it may be benzene, benzol, benzolene or gasoline. Kerosene must not be used.



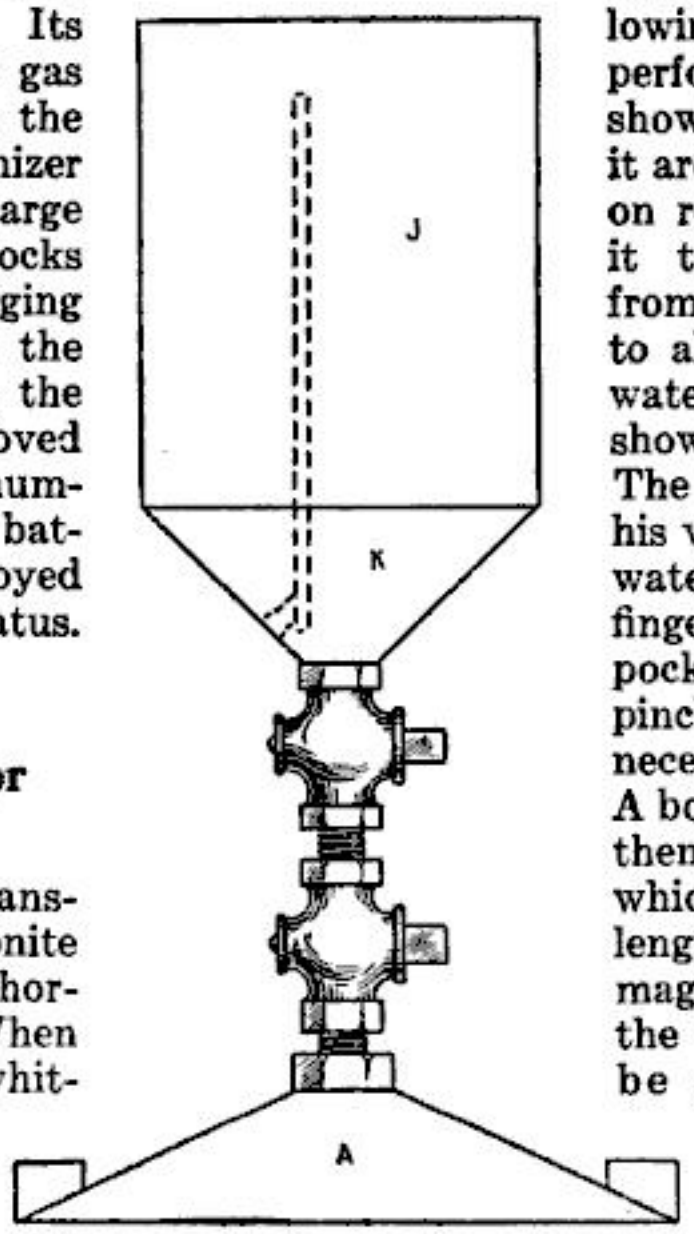
An economizer for charging coal gas with hydrocarbon

How to Make the Economizer

The outer cylinder is made of heavy tin plate while the distributing inside cylinder *A* may be made of lighter stock. A wire cylinder *B*, made of a ⅜ or ½-in. mesh galvanized wire netting is placed between the cylinder *A* and the outer case. The space between is packed moderately tight with dry white cotton waste, shown at *C*. The outer case is 9 in. high and 7 in. in diameter, with a cone-shaped cover attached to the upper edge. The inlet pipe *D* is provided with a stop-cock. This inlet and the outlet tube at *E* are both made of heavy tin plate, the latter being fitted with a brass gas union soldered at the top. The tubes are also soldered to the cone, while the inner cylinder *A* is fastened with solder at the point where it touches the cone. A hole is made at *F*, 1 in. above the bottom of the pipe *G*. This is to allow the gas to pass into the carbureter in case too much hydrocarbon has been introduced, which chokes the bottom of the tube and causes bubbling through the liquid, thus hindering the passage of gas. The tube *H* at the top of the cone is covered by a brass cap *I* in the interior of which is a leather disk to make a gas-tight joint.

An excellent method of filling the apparatus is to substitute two metal stop-cocks in the place of the tube *H* and another tank also made of tin plate, as here shown. By turning the two stop-cocks, the apparatus may be filled without wasting the fluid. One handle may be made to open and close the two. The tank *J* is filled with the carbonating fluid. The top of the carbureter, or economizer, is represented at *A*. A small

brass pipe, *K*, is fitted to the cone with solder. This pipe is so arranged that one end is near the hole of the stop-cock, the other end being a short distance from the top. Its function is to allow the gas to ascend, thus allowing the fluid to enter the economizer freely. As soon as the charge is completed, the stop-cocks are closed and the charging tank is unscrewed. When the operation is completed, the filling tank may be removed and used for charging a number of economizers in a battery, or it may be employed as a single piece of apparatus.
—ALFRED J. JARMAN.



A filling arrangement to introduce the liquid without waste

Making Diagrams for Lantern Slides

PROCURE a thin transparent sheet of zylonite or celluloid, and wash it thoroughly in distilled water. When dry, rub it with a little whiting in order to remove any grease. Drawings or writing can now be placed on the prepared plate as easily as if it were paper. Tracings made on the surface of the zylonite with India ink are superior in every way to those made on a gelatinized surface. The finished product should be clamped between two glass plates 3¼ by 4 in. The edges may be bound with paper.

A Glass of Water, Some Magic Passes, and Lo! The Water Is Wine

PUT a pinch of finely ground and sifted red sanders in a glass of water and the liquid will at once assume a red color similar to that of claret. If this liquid is poured into another glass previously rinsed with vinegar, it will assume a tint resembling that of brandy. If a little potash be added to it, it will change back into the original color and finally if a little alum be introduced it will become as black as ink. To a person not acquainted with the secret, it would appear as if claret, brandy and ink had been obtained from a glass of water.

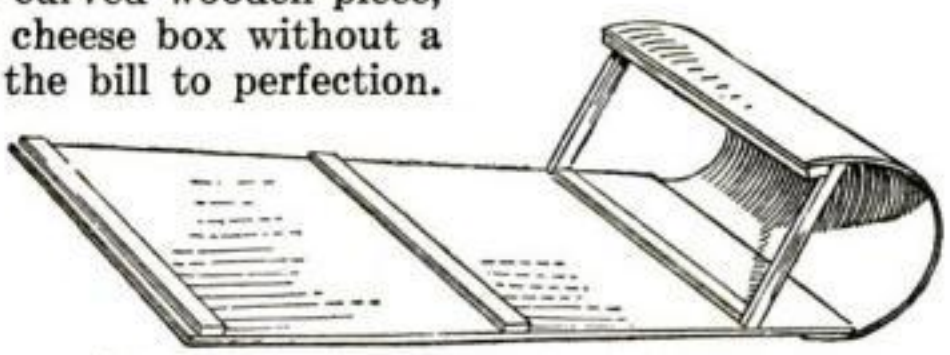
The spectators should think that only magic passes were responsible for the astonishing results. The following method is good. The performer comes forward showing a glass and passing it around for inspection. Upon receiving it back, he fills it two-thirds full of water from a pitcher. He then offers to allow anyone to taste the water, or tastes it himself to show that it is pure water. The red sanders may be in his vest pocket, and while the water is being tasted, the fingers carelessly seek the pocket and obtain a small pinch, which is all that is necessary to effect the change. A borrowed handkerchief may then be placed over the glass which is then held at arm's length in one hand while magic passes are made with the other, or the glass may be placed on a stand at the front of the stage. The handkerchief is placed over the glass for an instant and the water becomes rosy, the sanders being introduced while the handkerchief is being adjusted. The other changes are as easily effected and shown, the glass being previously dipped in the vinegar, and the alum introduced in the same way as was the red sanders.

Wine may be changed into water with equal facility and may be very nicely connected with the foregoing trick. The method is as follows: Dissolve 15 grains of permanganate of potash into 1 qt. of water. The resultant liquid will resemble claret in color. Add to this solution 45 grains of tartaric acid. Put into a bottle a few crystals of hyposulphate soda and a little water and rinse a glass with this solution. If the permanganate solution is poured into the glass it will be instantly decolorized. The tartaric acid should be introduced into the pitcher when the handkerchief is withdrawn, and the glass of course should be previously rinsed with the hyposulphate soda solution.

A Cheap Toboggan

NOTHING is more enjoyable and exciting than a toboggan slide down some steep incline. No one need forego this pleasure when a toboggan, as here described and illustrated, can be so cheaply constructed.

The essential part is the snow shield, which consists of a curved wooden piece, as shown. An old cheese box without a knot or crack fills the bill to perfection. First carefully take out the nails and pull out the top and the bottom.



A flat board strengthened with two cross pieces makes a toboggan. A curved section from a cheese box furnishes a snow shield

Next procure a good board the same width as the cheese box. It should be without cracks, and smooth on one side. Nail slats on the board, spacing them 1 ft. apart, and also fasten a strip on the end of the cheese box at the top, after the end of the box has been sawed off to the required length. Nail the other end of the box to the board, thus forming the curve or snow shield of the toboggan.

Place the side pieces connecting the top of the curved part with the board of the toboggan, thus forming handles and at the same time stiffening the shield. The top ends of the curve can be further strengthened by putting on strong leather straps.—PETER J. M. CLUTE.

The Mystery of Freezing Water Instantaneously

TO produce "ice" in the twinkling of an eye, as if by magic, is very simply and easily done.

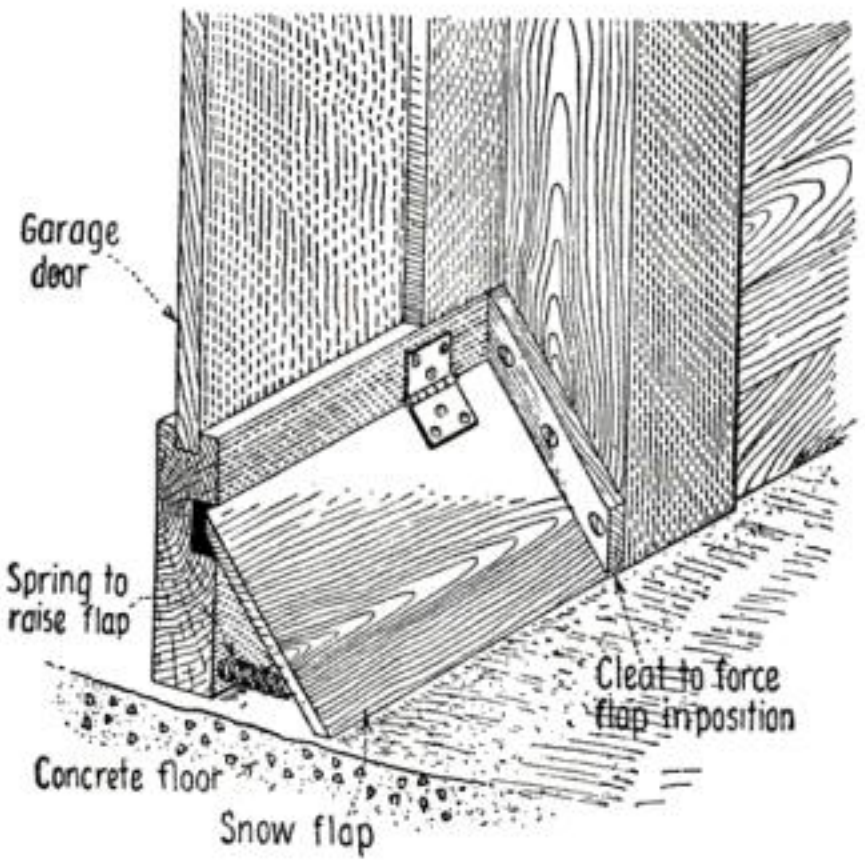
Place 50 grams, (about 2 oz.) of crystallized photographer's hypo in a small cup and add 10 cubic centimeters (100 drops) of water. Place the cup and contents on the stove, and in a few minutes the mixture will dissolve, forming a clear liquid solution. Now pour the mixture into a thin glass tumbler, the temperature of which has previously been raised by dipping it in hot water. Set the solution aside and allow it to cool, being careful not to disturb it. When cooled to room temperature, pick up the tumbler, give it a quick shake, or add a tiny crystal of the hypo, and the dissolved salt will instantly separate in a solid mass of crystals, apparently ice. At the same time, the tumbler which was previously cold, becomes decidedly warm, illustrating the scientific fact that water in freezing liberates heat.

Stop to Prevent Snow from Entering Under a Garage Door

LARGE garage doors must swing clear of the floor because there is no threshold strip at the bottom and this makes rather a large opening for snow to drift in on a windy winter's day. One owner of a private garage found that this opening caused considerable trouble as the doors faced the direction of most gales. He devised a drop, however, to work

automatically with the closing of the door. This stop is clearly shown in the illustration.

A groove was cut lengthwise of the lower rail in the door, so that the upper edge



A swinging board at the bottom of a door. It drops automatically as the door is closed

of a board or flap would enter as shown. This flap was hinged to the door and fitted with coil springs back of it to raise the board clear of the floor. A cleat was nailed to the door jamb at an angle so that when the door was closed the flap was pushed down on the floor.—HAROLD V. WALSH.

Exterminating Ground Hogs with Explosive Fumes

THERE are a good many ground hog dens in my locality. The animals are very bothersome to the farmers. I discovered a very quick, cheap and easy method of getting rid of them.

I take a pole about the size of the big end of a buggy whip and ten feet long. To the end, I tie a stick of 40% dynamite in which has been inserted a cap and two feet of fuse. I light the fuse, push the charge into the hole with the pole and then fill up the end of the hole with dirt. As it takes nearly a minute for two feet of fuse to burn down to the charge, this gives me enough time for the tamping.

The fumes of dynamite are very noxious. The explosion destroys the den and the fumes asphyxiate the animals that are in it.—CHAS. P. WALTERS.

Canvas Is Painted More Quickly When Wet

WHILE painting a heavy canvas screen, a painter was interrupted by a shower which lasted about a half hour. After the rain had stopped the work was resumed and the painter found that the wet fabric took the paint much more easily and quickly than did a dry surface. Now when he has canvas to paint, the material is first thoroughly wetted and much time is saved. If the canvas to be painted is large, he wets only about 10 or 12 square feet at a time. This is done to prevent the canvas from becoming dry again before it can be painted.—M. M. CLEMENT.

An Ingenious Carafe Used by the Eskimo

IN the north where it is almost always cold, a device for providing drinking water is made by hollowing out the top of a block of ice and putting in it a bit of moss, soaked in blubber and lighted. The moss floats on the water that soon is melted from the block. Then the Eskimo, to avoid the film of oil produced

A bit of oil-soaked moss burning on an ice cake provides the drinking water

by this floating lamp, drinks through a hollow bone, used as we use a straw. This is a new way of combining the elements of an iced drink—letting the ice hold the water.—TUDOR JENKS.

Tricks of the Trade

Attachments for Using a Vise as a Punch Press

A way to use an ordinary vise for making light duplicate parts from thin sheet metal

SMALL duplicate articles are ordinarily made in punch presses, but for the home workshop or a small jobbing shop such a press is too expensive. Ordinary punching or forming in 3/16-in. sheet metal may be handled in a vise with the power of the screw, by attaching the

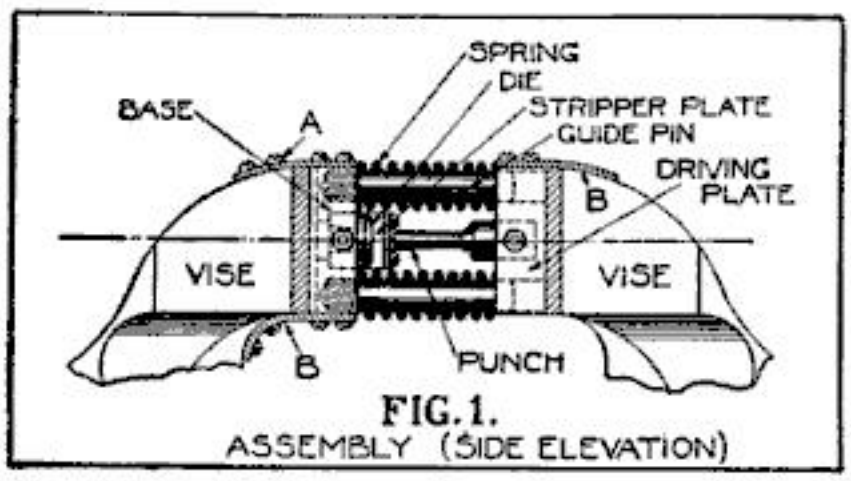


FIG. 1.
ASSEMBLY (SIDE ELEVATION)

The two parts attached to the vise jaws for holding the die and punch in line

specially constructed parts to the jaws as shown in the illustrations. With this device many small things can be turned out as rapidly and accurately as if made in a regular die press. The parts assembled are shown in Fig. 1.

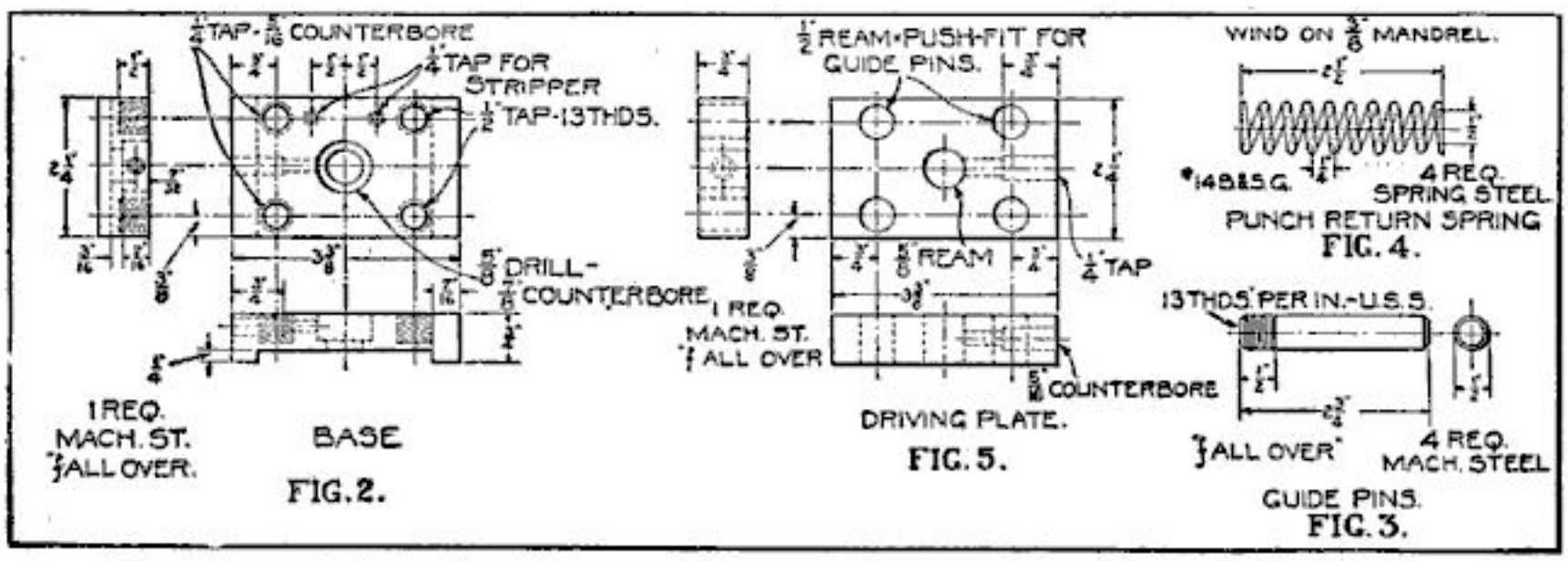
The base, Fig. 2, is attached to the fixed jaw of the vise by the upper and lower clips *A* and *B*, Fig. 1. These clips keep the base from pulling away from the vise jaw when the punch is pulled from the die. These clips are attached to the vise jaw with round head ¼-in. machine screws.

In Fig. 2 is shown four ½-in. tapped holes for guide pins, Fig. 3, two of which are plainly shown in place in Fig. 1. To assist in returning the punch after the operation, four helical springs, shown in Fig. 4, are slipped over the four pins.

The driving plate, Fig. 5, in general dimensions is a counterpart of the base. There are four holes drilled and reamed carefully to size for the ends of the guide pins. It is very necessary to make the base and drive plate accurately so that the parts will come together in line.

The stripper plate, Fig. 6, consists of two parts, the plate and its base block. The base block is merely a piece of metal cut to the size given, which supports the stripper far enough from the face of the die to permit the stock to be inserted for piercing.

The dimensions of the clips for holding the base and driving plate are given in the details of Fig. 5. Three punches and dies are shown in Fig. 8, 9 and 10, the simplest form being shown in Fig. 8. For ordinary punching, the punch face or end must be flat and have a clearance, as shown. Clearance is a slight taper from the cutting edge to the tank. The proper amount of this taper is 1/64 in. to each 1 in. in length. At the junction of the punch and the shank a heavy fillet should be formed as shown. Never make a punch with a square shoulder at this point.



Dimensions of the various parts used in constructing the holders for the dies and the punches to attach to the jaws of an ordinary bench vise for making small duplicate parts

The die face, in this particular case, is treated differently, as it is considerably higher near the center than at the outside. This gives a shearing cut on the stock, doing the work with far less power than if the die face were perfectly flat. The die must also have clearance as shown by the dotted lines. The hole is straight for a short distance —about 1/32 in.—then it becomes larger on a constant taper, the amount of taper being the same as for the punch. This provides a clearance for the punchings and permits them to fall through easily. The shallow hole in the side of the die is for the retaining set screw shown more clearly in Fig. 1.

The die and punch shown in Fig. 9 is for making a five pointed star in saucer shape. As this product is in the punching it must be formed in one operation. To do this the die face is made flat and the punch to shear, as shown. The amount of shear given to the punch face governs the amount of bend in the product, and, in special cases, it must be found by trial.

With this punch it will be seen that the points of the star are pierced first and are forced through as the punch enters the die, the punch continuing to shear the stock and to bend it into the desired shape.

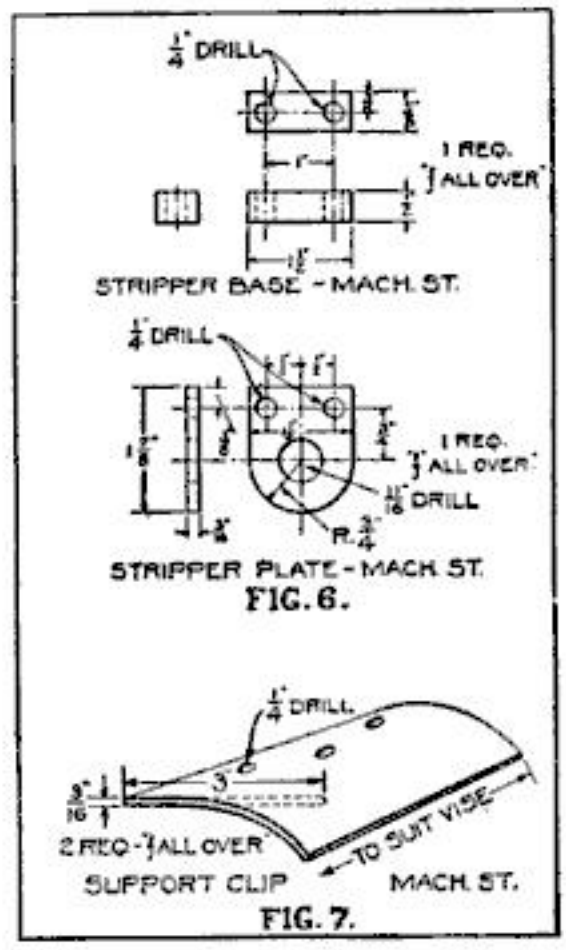


FIG. 6. FIG. 7.

Details of the stripper base and plate; also jaw clips to hold the parts

The concave to the punch face is produced by grinding. In the case of very small punches, the concave may be given by drilling before the punch is hardened, then, after the hardening, lapped with a piece of wood, oil and emery. The flutes may be chipped and filed, if there is no means of milling them with a formed cutter.

The die is marked out and drilled with a small drill so that it does not quite touch the outline or cut into the next drilled hole. To prevent the holes breaking into one another, fill the last drilled hole with a metal plug.

Another metal part in which the punching is the product is shown in Fig. 10. It is a complete ring. As in the other case, the die face is left flat and the shear to the punch face is all to one side as shown. The angle of shear determines the diameter of the finished ring. This also must be determined by trial.

If the face of the punch is made straight on an angle it will require considerable grinding throughout the cutting and will have a very short life. To obviate this wear, a short portion at the heel should be made equal to about one-half the thickness of the stock to be punched. At the terminal of the ring there will appear a straight, flat part, equal to the amount of the flat part on the punch. This can be finished by grinding or hammering.

These holding devices are not expensive to make, and where there is a good-sized vise at hand, small, round and square punches and dies may be used to advantage in punching holes in sheet metal for ordinary riveting or for tapped holes in fastening parts together with machine screws. The punches and dies for these operations are easily made.—J. B. MURPHY.

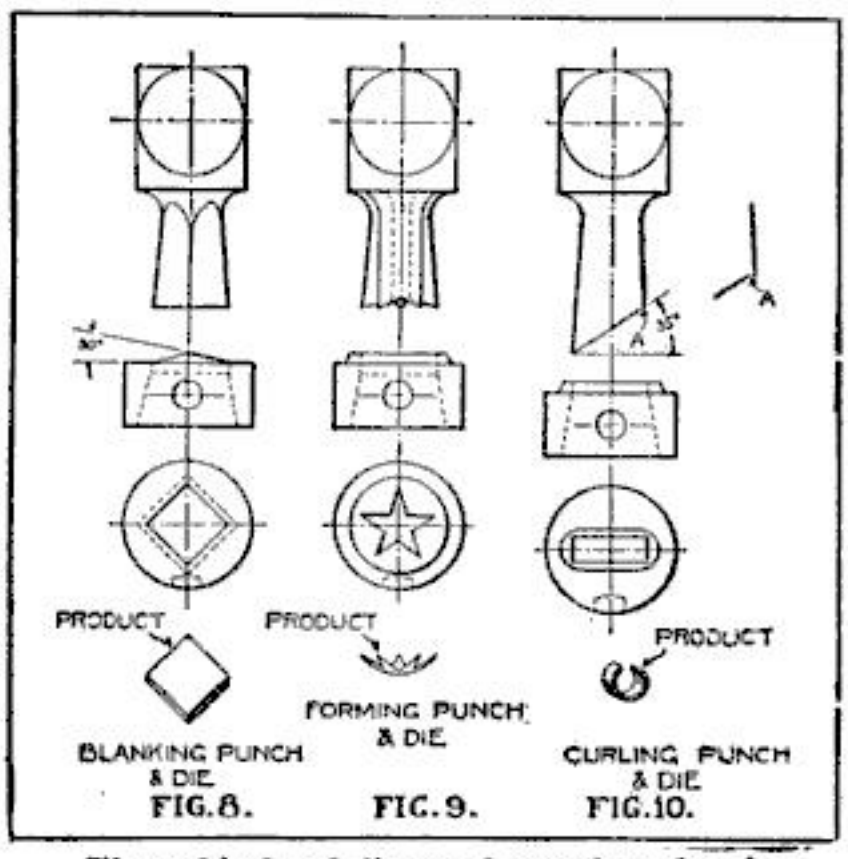


FIG. 8. FIG. 9. FIG. 10.

Three kinds of dies and punches showing their construction; also sample of work

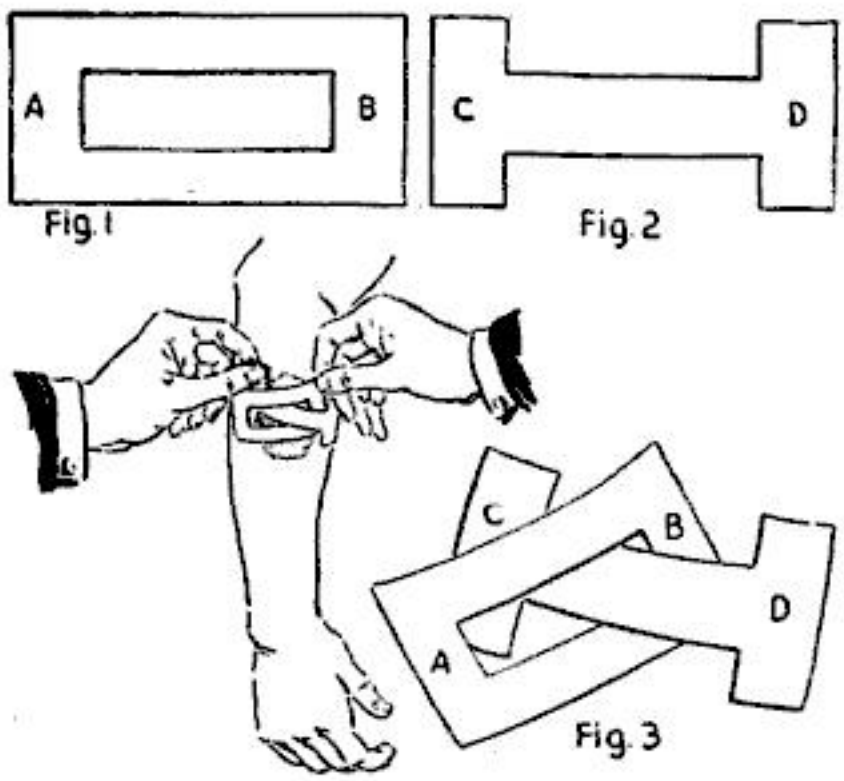
Drying Shoes with Heat from an Electric Globe

A WET shoe is one of the most difficult things to dry, and if the leather is to be thoroughly dried out, the heat must be applied from the inside. A golfer designed this device for drying his golf shoes and it is useful for any shoes that are worn in all kinds of weather. Place two electric wall fixtures so that the electric globes will be in upright positions, and hook a shoe over each. Then turn on the current. An 8-candlepower lamp will give sufficient heat to dry out the leather without burning it. The light fixture should be well supported to carry its weight and the weight of the shoe.—R. G. BROWN.

Drying your shoe over an ordinary incandescent bulb

Cutting Adhesive Cloth to Make Bandage Supports

ONE of the simplest and most effective bandages and supports for any surgical purpose has been devised by a prominent Philadelphia surgeon, and used successfully on a great number of his patients.



Method of cutting sheet adhesive for holding bandages firmly in place on a cut

Sheet adhesive is used, and the size of the bandage is decided by the place to be covered. After the length and width are determined, the adhesive is cut into a rectangle. Then a rectangular section of the center is removed as shown in Fig. 1. A second piece of adhesive, the length and width of Fig. 1, is cut to the shape of Fig. 2. The narrow strip will then fit closely into the opening, Fig. 1.

When applying the bandage, first fasten the ends *A* and *D*, then insert Fig. 2 through opening in Fig. 1, draw together and fasten ends *B* and *C*. A firm bandage and support will thus be secured. Adhesive sufficient for a large support can be bought cheaply at any drug store.—CHAS. M. STEWART.

Combination Tandem Seat and Tool Box

THE seat illustrated is built so that the person riding on it need not straddle the rear wheel.

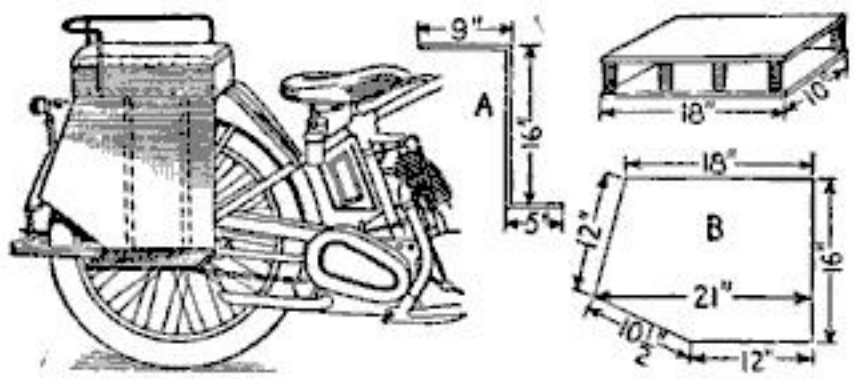
The material required for making the seat is as follows:

- 2 Pieces of hardwood 18 in. long, 10 in. wide and 1 in. thick
- 1 Piece hardwood 12 in. long, 6 in. wide and 1 in. thick
- 2 Pieces of iron bar 30 in. long, 11 in. wide and 3-16 in. thick
- 1 Piece of iron bar 12 in. long, ½ in. wide and ⅛ in. thick
- 8 Springs, 2 in. in diameter. Springs from old seats are suitable
- 32 Bolts 2 in. long
- 1 Piece of canvas
- 1 Piece of waterproof leatherette 30 in. wide and ⅔ of a yard long
- 2 Yards of gimp binding
- 5 Dozen leatherette headed nails
- 1 Piece of brass rod 3½ ft. long and ⅜ in. in diameter.

The seat frame is constructed from two pieces of 18-in. by 10-in. by 1-in. boards. Holes are first bored in the edges 1½ in. inside so that the 8 coil springs are evenly spaced and held in place with belts.

The two iron bars are bent at right angles in the shape shown at *A*. Six holes are drilled in each piece for the bolts, two in each straight length. These pieces are attached to the lower board of the seat on its upper surface so that they will hang down from one side.

A dustguard is made from the canvas piece as shown at *B*. This is cut large enough so that a seam at the edge may be made for holding the ⅜ in. rod, which is drilled, or a turn is put in at the right



Details of the parts for making a seat over the rear wheel of a motorcycle

place for fastening it to the mudguard and seat-frame. The upper edge of the canvas is tacked to the lower board of the seat. The lower edge is tacked to a small piece which is used as a footboard.

When these parts are finished, it is ready for the leatherette covering. This is fastened with tacks having leatherette-covered heads. Horsehair is packed in between the leatherette covering and the seat-board to form a cushion. The leatherette is tacked to the upper board and all surplus edges are cut away, leaving only enough for a flap over the rear opening between the boards where there is space for tools. This flap has some gimp binding sewed to its lower edge to keep the material from fraying. Two eyelets are made and buttons are attached to the wood so that the flap may be used to keep tools from falling out.

The seat is finished with a ⅜-in. brass rail, which must be bent in the shape shown and attached with screws to the edge of the upper board. A rubber foot pad attached to the footboard adds to the appearance of the seat—RAY E. STEWART.

Chemical Composition to Make Uninflammable Benzene

ONE of the most extensively used cleaning mixtures on the market has its wide sale because it is not inflammable as benzene and similar products are. It is practically nothing but a mixture of benzene and carbon tetrachloride which when mixed in certain proportions will not burn or explode when a match is applied to the mouth of the container. It was found that the best results were obtained when these two substances were mixed in the proportion of nine parts, by volume, of carbon tetrachloride to one part of benzine. This mixture does not detract from the cleansing properties of the benzene but rather adds to them.

A Leaky Tire Valve and Its Method of Repair

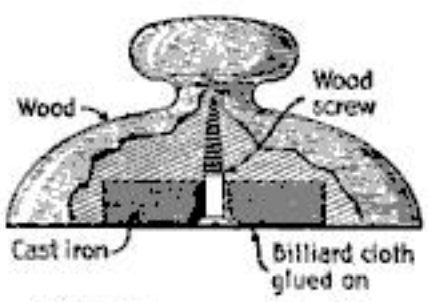
A LEAKY valve is the cause of many a flat tire, but the valve itself is not always at fault. Very often, even after a new "insert" (the inside part or valve proper) is bought and put in, the slow leak is as bad as ever. The trouble is in the rubber gasket inside the cap. This becomes displaced and swung around so that it presses on the stem and causes the air to pass out slowly. The motorist naturally screws the cap down tighter in an attempt to stop the leak which only aggravates the trouble. Straightening the cap will effectually stop the leakage.

Cements for Securely Fastening Celluloid Parts

CELLULOID scrapings dissolved in acetone make a very good cement. The resultant solution should be heated slightly to clear it up. Another satisfactory way is to moisten the two surfaces with ordinary wood alcohol and press a weight over them. Shavings of vulcanite dissolved in sulphuric ether also serve the same purpose.

Making a Substitute for Brass Paper Weights

A LARGE corporation recently made a canvass of its offices and collected all of the brass paper weights for the metal. In order to supply paper weights to take the place of those collected, one was devised that is inexpensive, ornamental and useful. The body is made of wood, which is turned in a lathe. A recess is made in the bottom, in which a piece of cast iron is held in place with a wood screw.—J. R. MINTER.



Wooden covering for a metal paper weight

Simple Designs for Sheet Metal Working

X—Radial line development of patterns for cones and parts of cones

By Arthur F. Payne

Former Director of Vocational Education, Columbia University

MOST of the patterns developed in this series up to the present time have been for objects cylindrical in shape. The majority have been elbows and tees. These cylindrical patterns all

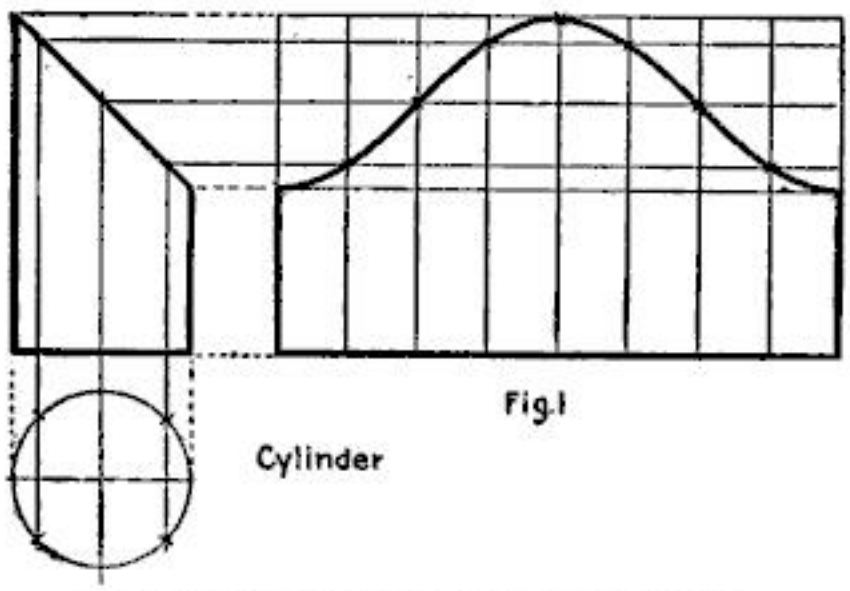


Fig. 1

Cylindrical patterns all belong to the parallel line group. All lines parallel

belong to the parallel line group, that is all the lines in the drawing are parallel lines as in Fig. 1, which was demonstrated in the June, 1917, issue.

In Fig. 2, we see the first problem of the group of patterns developed by means of radial lines. The patterns developed by this method are all of objects that are conical in form. In the illustration we have a perspective drawing of a cone, marked *A*, also a front view marked *B*, a bottom view marked *C*, and the pattern for the cone. The three parts of a cone, base, apex, altitude, are also indicated.

The method of developing the pattern for this simple cone is easily understood. First, draw the front view *B* the size desired. Second, draw the bottom view *C*, which is, of course a circle, the diameter of which is equal to the base of the cone. Third, divide the bottom view into sixteen equal parts. Fourth, set your pencil dividers with one point at the apex of the cone and the pencil point at the right corner of the base, then draw the arc *D-E*. Get the correct length by measuring one of the spaces on the bottom view and stepping it off sixteen times on the arc *D-E*. Draw the lines from both points numbered one and the pattern for the cone is complete. This pattern is merely the size and shape obtained by tracing the outline of a cone rolled once around on a sheet of paper.

Fig. 3 shows the development of the patterns for a megaphone. It will readily be seen that this megaphone is simply two cones with their tops cut off and joined together. When the top of a cone is cut off, it is called a "truncated cone." To develop the patterns for these two "truncated cones," which make the megaphone, first, draw the front view as shown at *B*. Second, draw bottom view as shown at *C*. Third, to get the pattern of the large "truncated cone" *B*, we must first locate the "apex" of the cone, in other words, we must complete the cone. This is now done by the dotted lines meeting at *F*. Next we proceed in the same manner as we did in Fig. 2, that is, we divide the

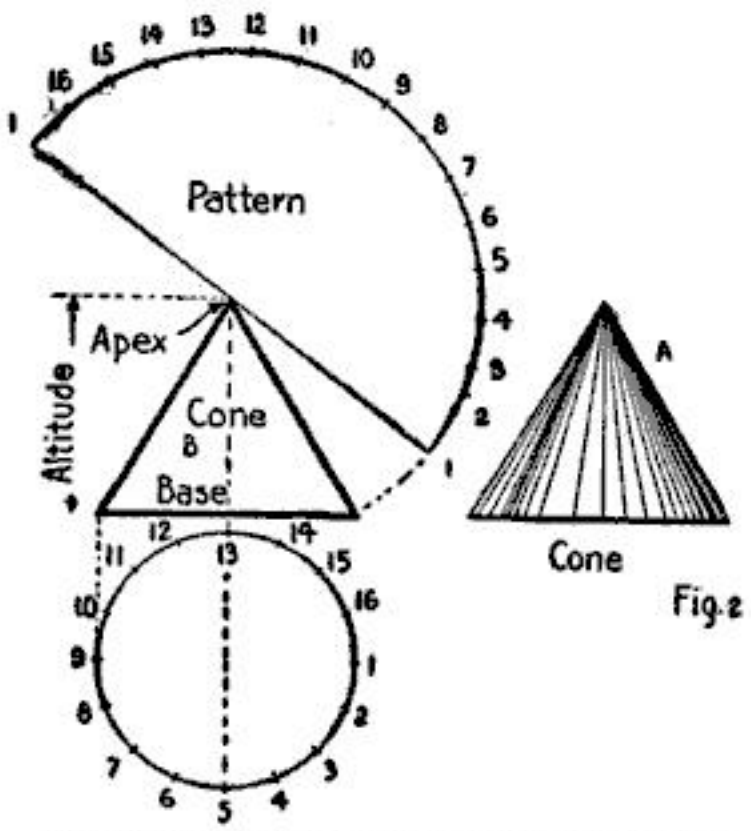


Fig. 2

Patterns developed by radial lines are all of objects that are conical in form

bottom view into sixteen parts, place the pencil dividers at *F-G*, draw the arc *D-E*,

find the correct length by stepping off one of the bottom view spaces sixteen times and we will have the pattern for

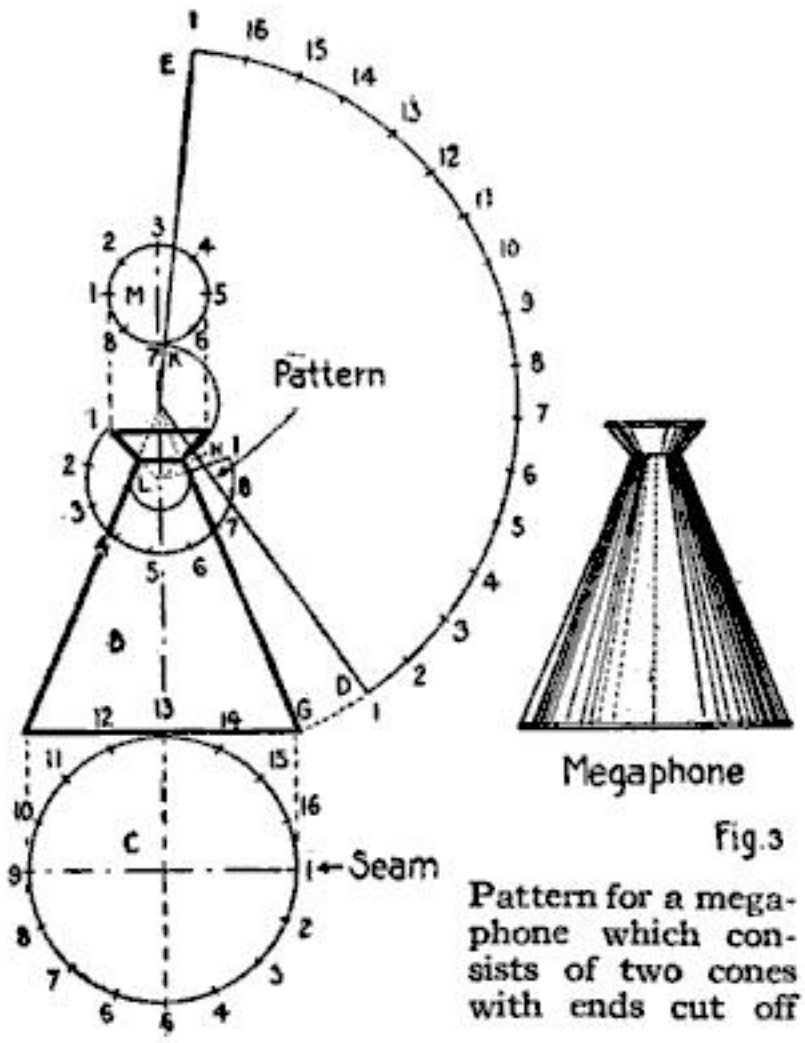


Fig. 3

Pattern for a megaphone which consists of two cones with ends cut off

the complete cone. Fourth, to obtain the pattern line for the part that is cut off, set the pencil dividers at *F* and then along the line *F-G* at the point where the small cone is joined to the large cone, draw the arc *H-K* and the pattern is complete. For the small cone, the method is the same, the apex of this cone being marked *L* and the bottom view marked *M*.

In the illustration for the funnel, Fig. 4, the methods of developing the patterns are the same as for the megaphone. However the following helpful short cut has been introduced. In all of the patterns demonstrated so far, a full bottom view has been drawn. This is not always necessary and it saves time if one half the bottom view is drawn from the center of the base line, as shown at *A*. We know that the other half is exactly the same. When this pattern is developed, we also know that the other half of the pattern is the same. The apex of the large cone is marked *B* and that of the small cone *C*.

In the last article of this series a method of developing an approximate sphere by means of parallel lines was shown. In that sphere the sections were vertical, in the sphere shown in Fig. 5 the sections are horizontal, and the patterns are developed by means of radial lines. The method followed is exactly the same as for the megaphone and funnel. Only the half pattern is shown for segment *A* and *B*. The entire pattern is given for *C*. This sphere may be made of any number of segments, the greater the number of segments the rounder the sphere, and the more difficult the problem will be.

In Fig. 6, the "hopper," we have a real demonstration of development by radial lines. The other problems in this article have been given as a preparation for this one. Suppose we need a pattern for a hopper through which material is shoveled into a machine as is roughly indicated in sketch *A*. The first thing we must do is to see that the hopper is part of a cone. We must then draw the complete cone as is shown, getting the base, apex and altitude. Second, we must draw the full cone and lay out the part needed for the hopper as shown at *B*. Third, draw the bottom view *C*, divide into sixteen parts and draw the lines straight up until they strike the base of the cone. Then draw them converging to the apex. Fourth, draw the arc *D-E* with the apex as the center. Get the true length of the arc by stepping off the sixteen spaces of the bottom view. Fifth, from each of

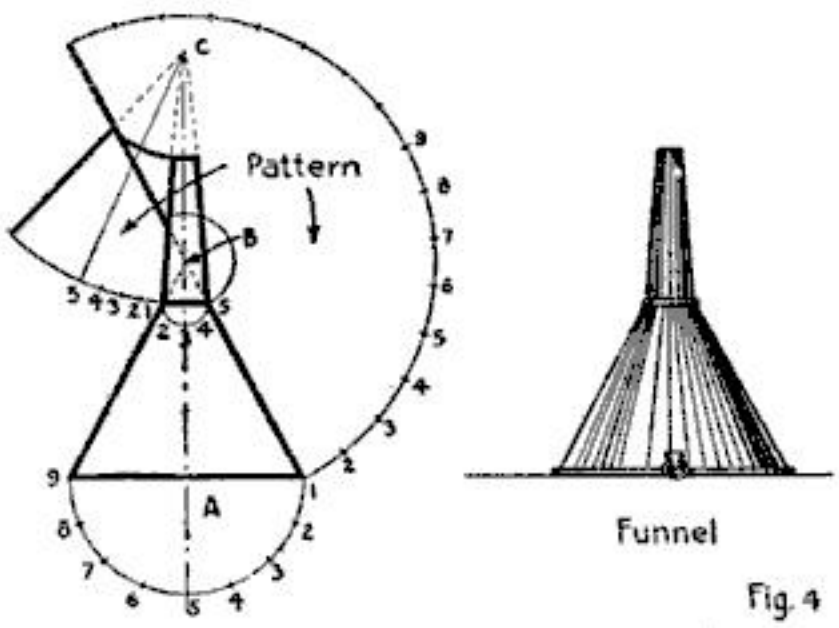
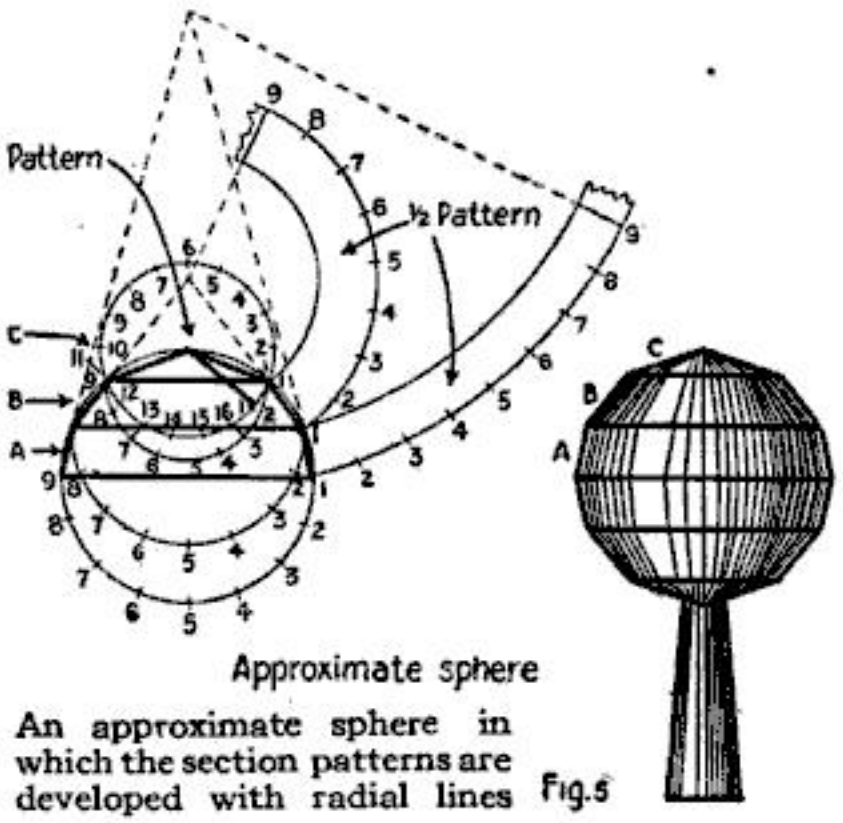


Fig. 4

A pattern for a funnel is the same as for a megaphone but a short method is used

these numbered points draw a line to the apex. Sixth, comes a part that is somewhat difficult to understand. It concerns the true and the apparent or false length of some of these lines. The explanation is this: if we measure the

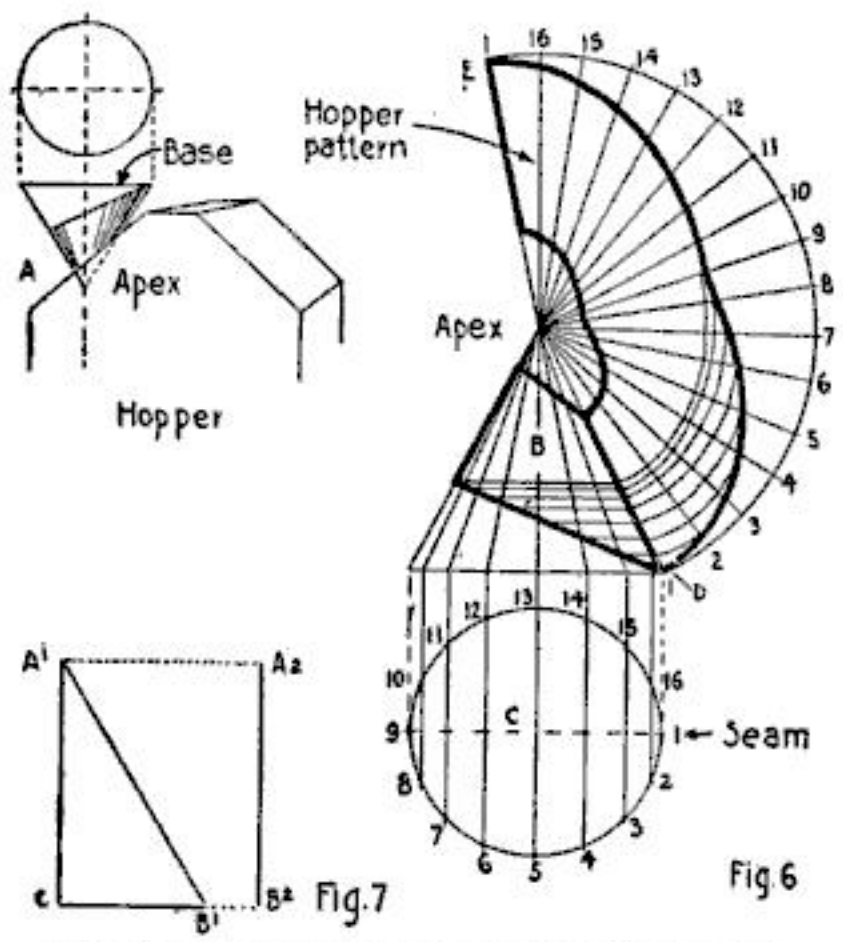
line 1 from the cone base to the apex and also measure line 13 from the cone base to the apex, we, of course, find the line 1 is the longest. In reality we know that



An approximate sphere in which the section patterns are developed with radial lines Fig. 5

all the lines from the base to the apex are the same length, but some *appear* shorter because if they were on a cone made of tin, they would project out towards us and would naturally appear shorter.

If we study Fig. 7 this will be more readily understood. If the line *A1-B1* is



The hopper is a good example for showing the pattern development by radial lines

one of the edges of a triangle lying flat on the paper, all three lines representing the three edges will appear in the true length, but if the triangle is turned so that the edge *A1-C1* rests on the paper, then the line *A1-B1* will be projecting from the paper towards us and the line *A1-B1* will appear shorter as in *A2-B2*. If we were speaking technically we would say the line was "foreshortened." This is the principle back of the method of developing patterns by triangulation which will be taken up soon.

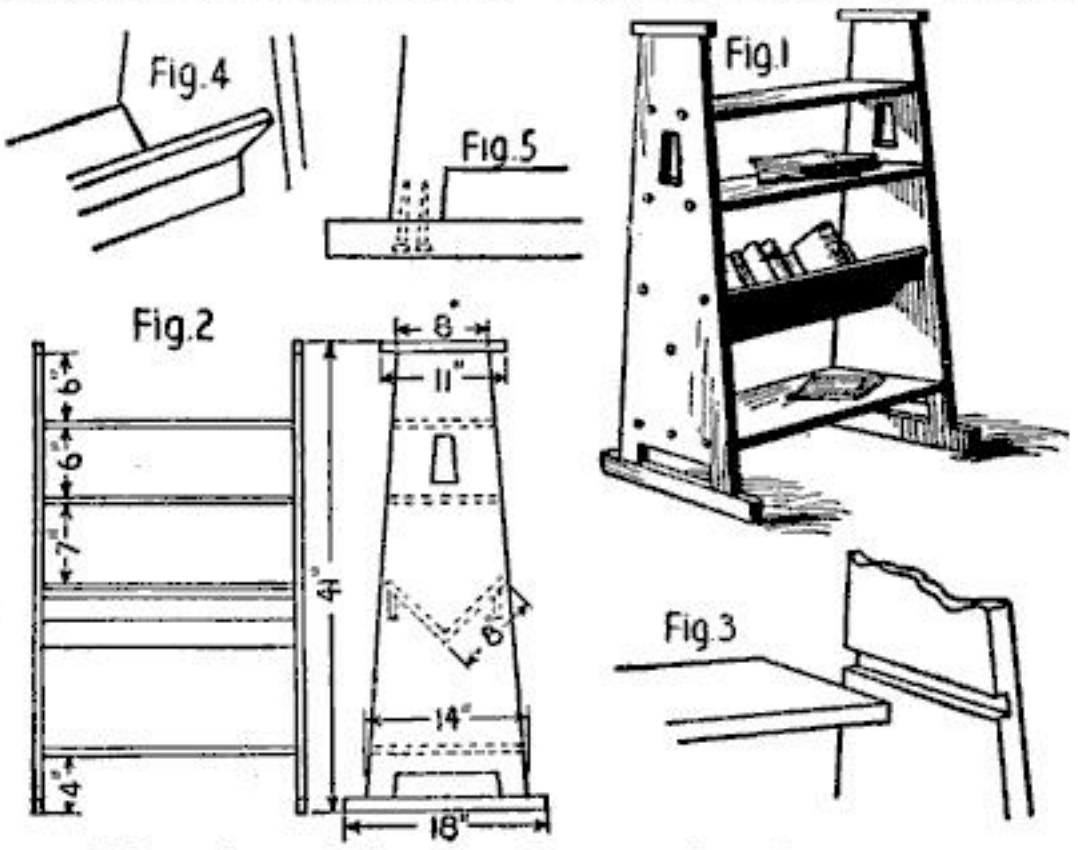
Going back to Fig. 6, we can now see that lines 1 and 9 on the outside of the cone are the only lines that are shown in their true length. To get the true lengths of the other lines on the cone for our pattern, we must draw them over to the left until they strike line 1-apex as shown in the drawing. Then with the apex as a center, swing these lines in an arc until they intersect with the same numbered lines coming up from the arc *D-E*. To explain this process in a different way to make it more easily understood, run point 1 from the bottom view upward to the base line. Next run points 16 and 2 upward to the hopper line, next over to line 1-apex, then in an arc until it strikes line 2 and 16 on the pattern, making a cross at these points. Next run lines 15 and 3 upward to the hopper line, then over to line 1-apex, then in an arc until the arc line intersects lines 3 and 15, and make a cross at the intersection. Do the same with all the other points on the bottom view, connect the crosses with a curved line and we will have the line for one side of our pattern. We must now repeat the same process for the other hopper line near the apex of the cone as is shown in the drawing, and we will have the full pattern for the hopper.

Deodorizing Benzene for Dry Cleaning Purposes

BENZENE is very useful for the removal of grease spots and various other stains. Its odor, however, is very disagreeable to the average housewife. This may be completely removed by repeatedly shaking up the benzene with a plumbate of soda solution, and rectifying it. The plumbate of soda is made by dissolving litharge in caustic soda.

A Book Shelf and Trough Made of Soft Wood

THE illustration shows the construction of a simple book shelf and trough combined. The sides are made of 1-in. yellow pine boards that taper in width from 14 in. at the bottom to 11 in. at the top. The strip at the top extends over the edges of the upright boards 1 in., and the base strip extends out 2 in. The shelves are fitted into grooves ¼ in. deep. In the place of one shelf, a trough is set in which holds the books in an upright position. The shelves are convenient for large volumes. Besides gluing all parts together, round head screws are used to strengthen the joints, and to improve the appearance. The completed book shelf can be finished with two coats of stain and one of either varnish or wax. For small jobs like this, it is best to procure finishing material in small cans from your dealer. Follow directions on the containers as different makers recommend different use of such products.—H. ALDEN.



Dimensions of the parts that enter into the construction of a simple combination book shelf and trough

Glass Cements for Commercial or Domestic Use

WHEN finely pulverized chalk is stirred into a solution of water glass at 30°B. until the resultant mixture becomes fine and plastic, a cement of extraordinary durability is obtained. It will harden in about seven hours. The cement, when mixed with a little zinc dust, will adhere to almost any surface. After burnishing, such a cement will exhibit the white and brilliant appearance of metallic zinc. A small quantity of carbonate of copper added to the chalk will produce a bright green cement. Cobalt blue wil give it a splendid blue coloration, vermilion a bright red, and carbon red will produce a violet color.

A Good Elastic Varnish for Coating Blue Prints

THE greatest drawback to the use of drawings or blue prints in machine shops and factories, is that they soil so quickly owing to handling. This obscures the dimensions of the various machine sizes, making their reading slower, and allowing possibilities for mistakes. In order to keep blue prints clean and make them last longer, one chief draftsman coats them with a flexible and waterproof varnish. This enables the drawings, or blue prints, to be wiped off with a wet cloth when they become soiled. It also allows them to be taken into damp places.

The formula for the varnish is as follows: Crush transparent and clear pieces of gum damar into small grains, then place a convenient quantity—say forty grains—in a flask. Pour on it about 6 oz. of acetone and expose the whole to a moderate temperature for about two weeks, or until the mixture has dissolved. It is necessary to shake the flask frequently.

At the end of this time, pour off the clear saturated solution of damar in acetone, and add to every four parts of the varnish, three parts of rather dense collodion, mixing the two solutions by shaking. The resulting fluid is allowed to settle and it can be preserved in well closed phials.

This varnish is applied in vertical lines by means of a soft camel's hair brush. At the first application it will appear as if the surface of the paper were covered with a thin white skin. As soon, however, as the varnish dries, it presents a clear shining surface. The varnish should be applied in three layers, or coats. It will be found by experience, that this varnish retains its gloss and remains pliable under all weather conditions.—W. S. STANDIFORD.

A Small Sewage Disposal Plant

The Department of Agriculture tells in a bulletin how to construct a sewage disposal plant for the country place. This article is an extract from that bulletin

EXPERIENCE has shown that, in a small sewage disposal system, a dark, airtight tank of sufficient capacity and so constructed that sewage may remain in it entirely at rest for a period of from 18 to 24 hours, gives the best results. The solid matter settles out in such a tank and, according to the theory at present accepted, it is partially liquefied, deodorized and destroyed by countless numbers of bacteria, which thrive without air.

In such a tank a thick scum forms on the surface of the sewage, which protects the bacteria from the incoming air and is evidence of good bacterial action. The breaking up or disturbance of this scum destroys the bacterial action for the time being and is likely to cause considerable annoyance from bad odors.

The septic tank effects only about 40 per cent purification. The liquefying action in the tank, however, makes it possible to subject the sewage to a final treatment by filtration or distribution in a natural soil. This final purification is effected by means of bacteria which work in air. Therefore it is necessary that the sewage should enter the disposal system intermittently so that the system may be given a chance to air out. If the sewage enters continuously and in such quantities that the system is kept saturated, the filter or disposal area becomes waterlogged and "sewage sick" and ceases to be effective. It is therefore necessary that the final treatment system be of sufficient capacity to dispose of each dose of sewage quickly.

The septic tank for a small sewage-disposal system should ordinarily consist of two chambers. In this type of tank, the sewage is received, settled, and partially purified in one chamber, and collected and discharged from a second chamber. This type of tank, if properly designed, should operate satisfactorily. The sewage in the settling chamber suffers little disturbance, and the discharge to

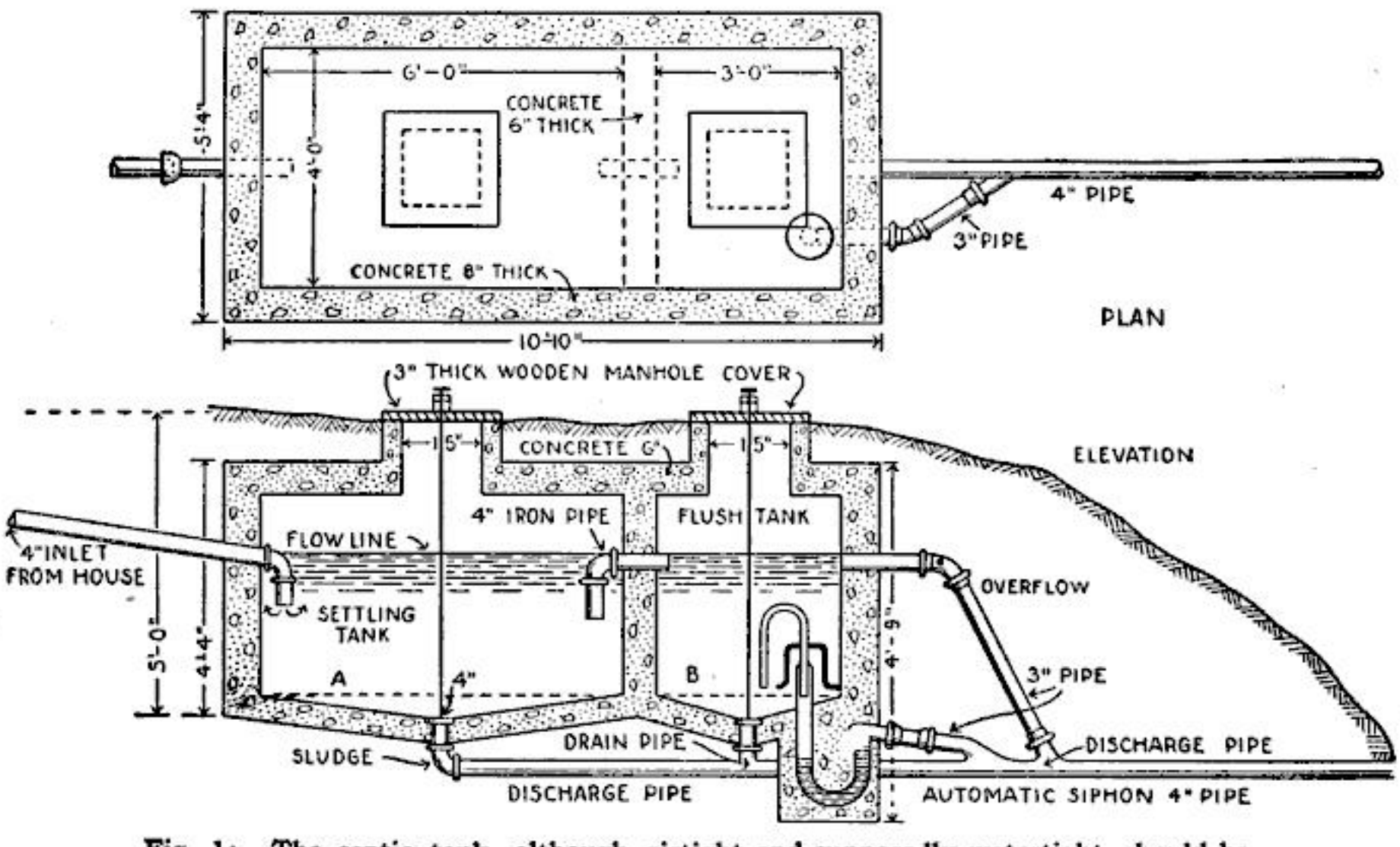


Fig. 1: The septic tank, although airtight and supposedly watertight, should be located as far from the house and the well or spring, as local surroundings will permit

the final disposal system may be made intermittent by means of an automatic siphon placed in the discharge chamber.

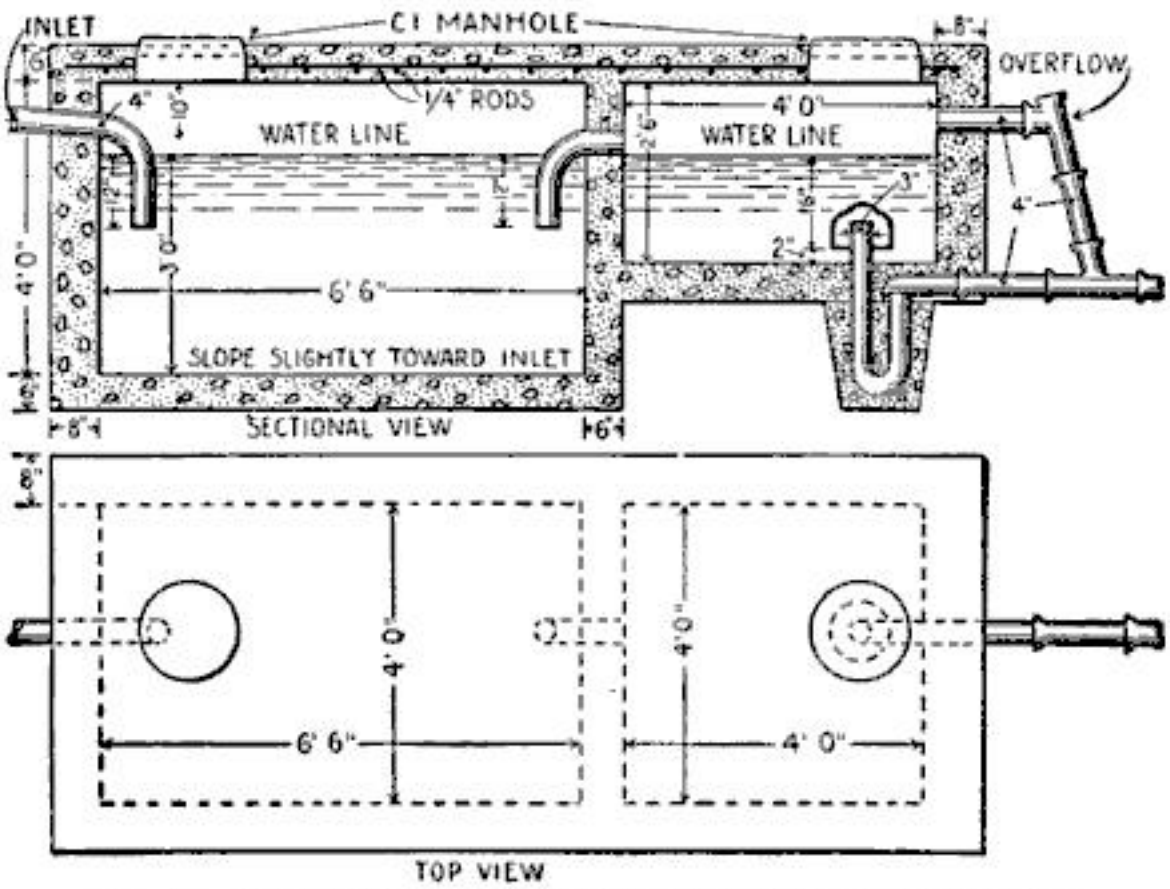


Fig. 2: A septic tank of larger dimensions suitable for a family of eight persons, and one that can be used where there is plenty of fall to carry away the liquefied matter

Experience has determined that the settling chamber of a small septic tank should have a capacity of from 5 to 15 cu. ft., or from 40 to 80 gal. per person in the family. The best results are obtained when the capacity approaches a larger limit, so that 18 to 36 hours' sewage from the house may be held at one time, to undergo sedimentation and bacterial action for this length of time. Care should be taken not to make the tank so large that liquefied sewage remains in it more than 36 hours, lest putrefaction set in.

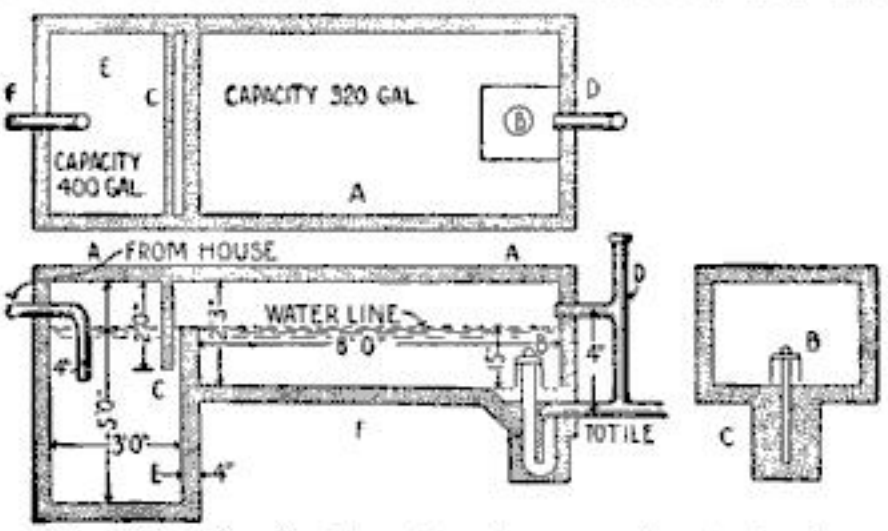


Fig. 3: A double chamber septic tank for use of six or more persons. It is practical where the outlet fall is difficult to obtain

For this reason one should make an accurate estimate of the daily sewage flow, which will be practically equal to the daily water consumption. Although a depth of 3 ft. may be sufficient for some classes of sewage, it is better to have the depth from 4 to 8 ft., according to the number of people, in order to give the sludge a good chance to settle and liquefy. The width of the chamber may ordinarily be about one-third or one-half the length, although this may vary for economy and convenience. The width should not be less than 3 ft., however.

The inlet from the house should be provided with an elbow, so that the discharge will be at least a foot below the contained sewage, thus preventing disturbance of the surface scum. The outlet from the settling chamber should be equipped in the same way. Where the entrance and discharge velocities are very strong, baffle walls of wood or concrete should be placed before these openings to break the current. These precautions are especially beneficial in the smaller sized tanks.

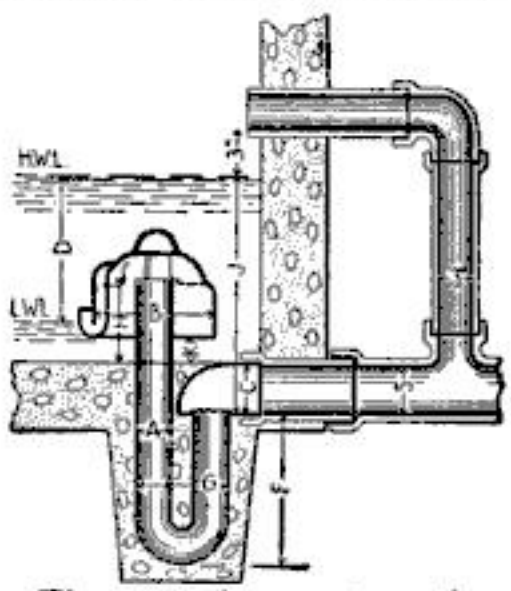


Fig. 4: An automatic siphon that may be set to operate at certain intervals

The discharge chamber should be of such capacity and depth as to discharge about every 10 or 12 hours. It may be desirable to discharge at more or less frequent intervals according to the nature of the soil in the disposal area. This action may be controlled by the arrangement of the discharge chamber and the siphon. Where little outlet fall is available it is possible so to construct the discharge chamber that its floor will be considerably above that of the settling chamber.

The capacity and depth of discharge chamber and the size of siphon will depend on the number of persons served and the means of disposal. If a sand filter or a distribution system in

heavy loam soil is used, the discharge chamber must be larger and deeper, in order that the discharge interval may be lengthened and the distribution system be given ample time to aerate. If the distribution is in sandy or very porous soil the discharge may be more frequent.

The table of dimensions of septic tanks suggests sizes of settling and discharge chambers and the corresponding siphon sizes to apply to various average conditions. The depths of siphon chambers given are the minimum allowable.

The table is computed on the basis that the inlet and outlet of the settling chamber should be placed with their inverts 12 in. below the roof of the tank, thus making the depth of sewage in both settling and discharge chamber 12 in. less than the mean inside depth.

The tank dimensions given are for average cases only and are not standard for all such cases. They are subject to variations to suit local conditions; yet care should be taken not to vary any of the essential dimensions, and not to go below the given minimum depth of the siphon chamber.

In the illustration Fig. 1, is shown a double-chamber septic tank for a family of six people. Another type of tank for a family of eight people is shown in Fig. 2. These tanks are suited to conditions where plenty of outlet fall is available. A double-chamber tank for a family of six persons is shown in Fig. 3. This tank is suited to flat ground where outlet fall is difficult to obtain, as will be noted by the difference in elevation between the floors of the two chambers. For satisfactory operation, a small septic tank should be a size suitable for use by at least six persons.

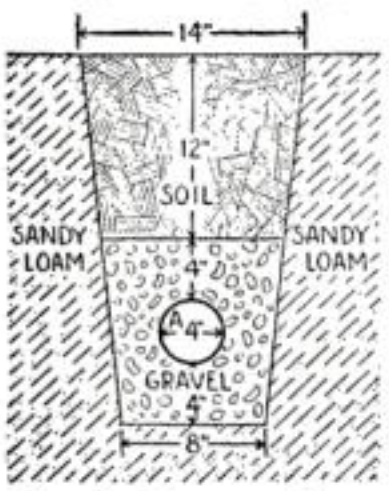


Fig. 6: Cross section of a single tile sewage disposal system

The septic tank, although airtight and supposedly watertight, should be located as far from the house and the well or spring as convenience and local surroundings will permit, thus reducing the danger of pollution or nuisance in case of leakage or improper operation of the system.

The sewer from the house should be of vitrified sewer pipe, usually 4 in. in size, with tightly cemented joints, and should

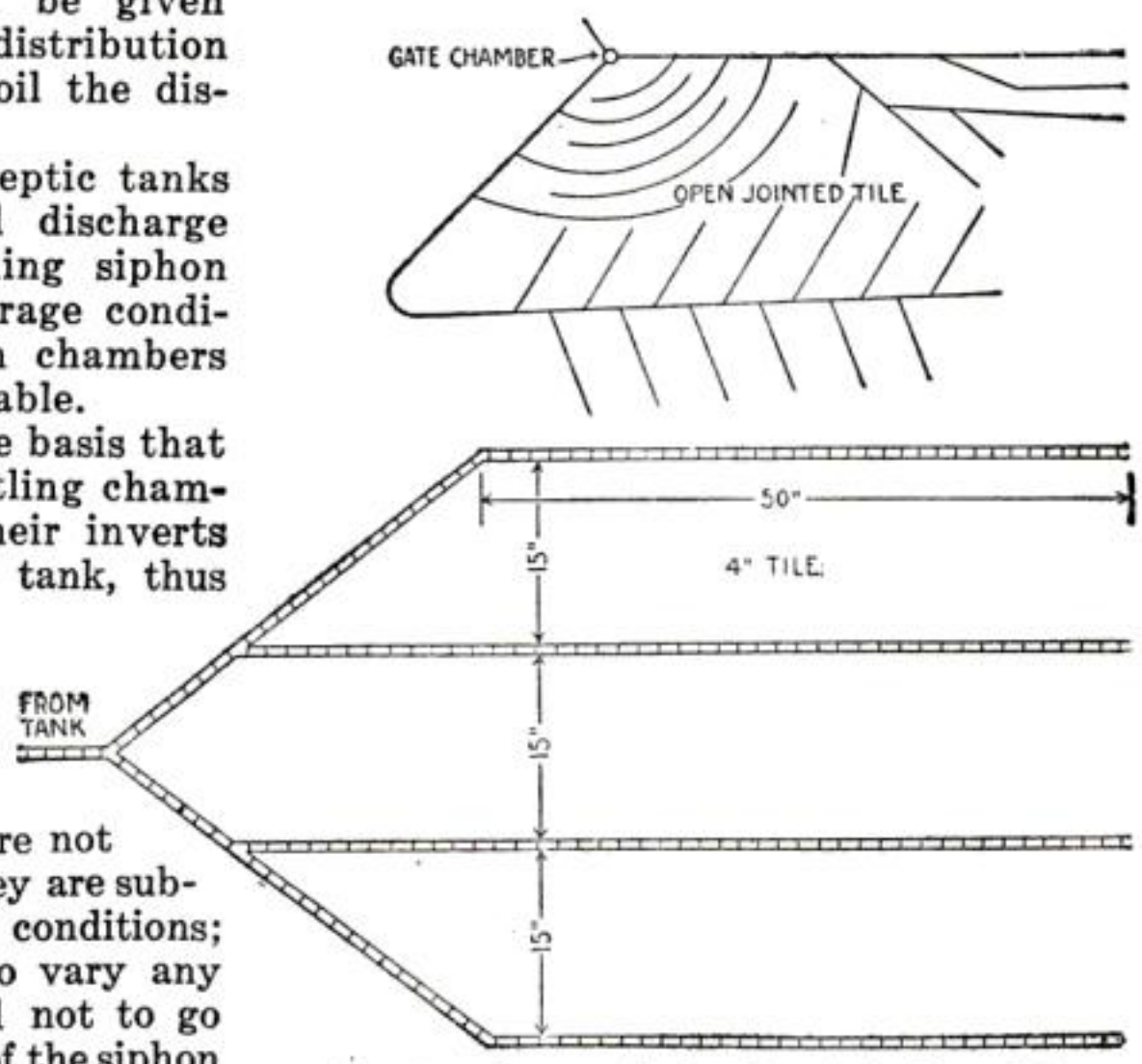


Fig. 5: A ground plan for the laying of the tile in a system leading from a sewage disposal plant to drain the tanks underground

be laid to a grade of less than 9 in. per 100 ft. Where the fall from the house to the tank is excessive, it is a good plan to lay at least 100 ft. of tile to the minimum grade to break up entrance velocity.

It is assumed that the farmer has a working knowledge of small concrete structures. The septic tank, preferably of concrete, should be made as nearly watertight as possible. The walls should be 6 or 8 in. thick, the floor 4 to 6 in. thick, and the roof about 6 in. thick and reinforced. Some means should be provided at the bottom to facilitate the cleaning out of the settled sludge. Either the floor may be sloped toward

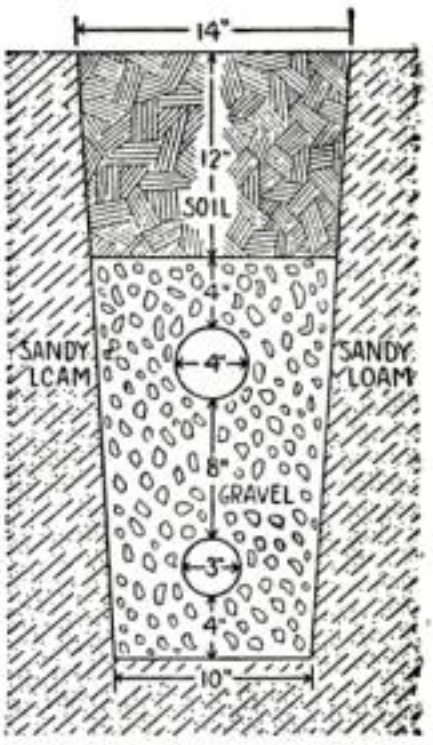


Fig. 7: A single tile system with underdrainage tile

the inlet-end for this purpose or a pipe with a valve may be installed below the tank, as shown in Fig. 1 and 2. The discharge chamber should be fitted with an outlet, set above the siphon, which will allow the sewage to escape in case the siphon becomes clogged.

A concrete mixture of 1 part cement to 2 or 2½ parts sand and 4 or 5 parts of broken stone or gravel should be used in the construction of the tank, It is an excellent idea to waterproof the concrete.

An automatic siphon is shown in Fig. 4. It operates as follows: As the liquid enters the discharge chamber its weight increases with increasing depth, and the air between the water surface in the bell and the water in the siphon-leg is compressed. As the water outside increases in depth, the compression inside becomes greater until the water outside reaches the drawing or discharge depth for the siphon. Then the inside pressure is sufficient to force the water in the siphon-leg around the bend, instantly relieving the compression. The water from the tank then rushes in to fill up the space which was occupied by the air and starts the siphon, which continues until the outside and inside pressure are again equalized.

Where the soil is porous or sandy and there is plenty of area available, which is used for no other purpose, the sewage from the septic tank may be discharged through 4-in. distribution tile laid on the surface of the ground in gridiron or herringbone fashion. The area necessary is from 450 to 500 sq. ft. for each person served, if the soil is very porous or sandy, and the soil should be either tile-drained or have natural underdrainage.

A better method of disposal is by subsurface distribution. In this method the tiles are placed in the ground in herringbone or gridiron fashion, not deeper than 14 or 16 in. from the surface of the soil to the top of the tile. Ground plans for such systems are shown in Fig. 5. In very porous or sandy soils 1 ft. of 4-in. tile per gallon of discharge for each day is sufficient. In the heavier loam soils 2 ft. or sometimes more of 4-in. tile for every gallon necessary. A rough estimate should be made of the number of gallons of sewage in each discharge from the tank and the number of discharges per day. Not less than 35 ft. of 4-in. tile per person should be used in sandy or porous soil and not less than 60 ft. per person in very heavy loams. In average loams 300 to 400 ft. of tile are sufficient for a family of six or eight persons.

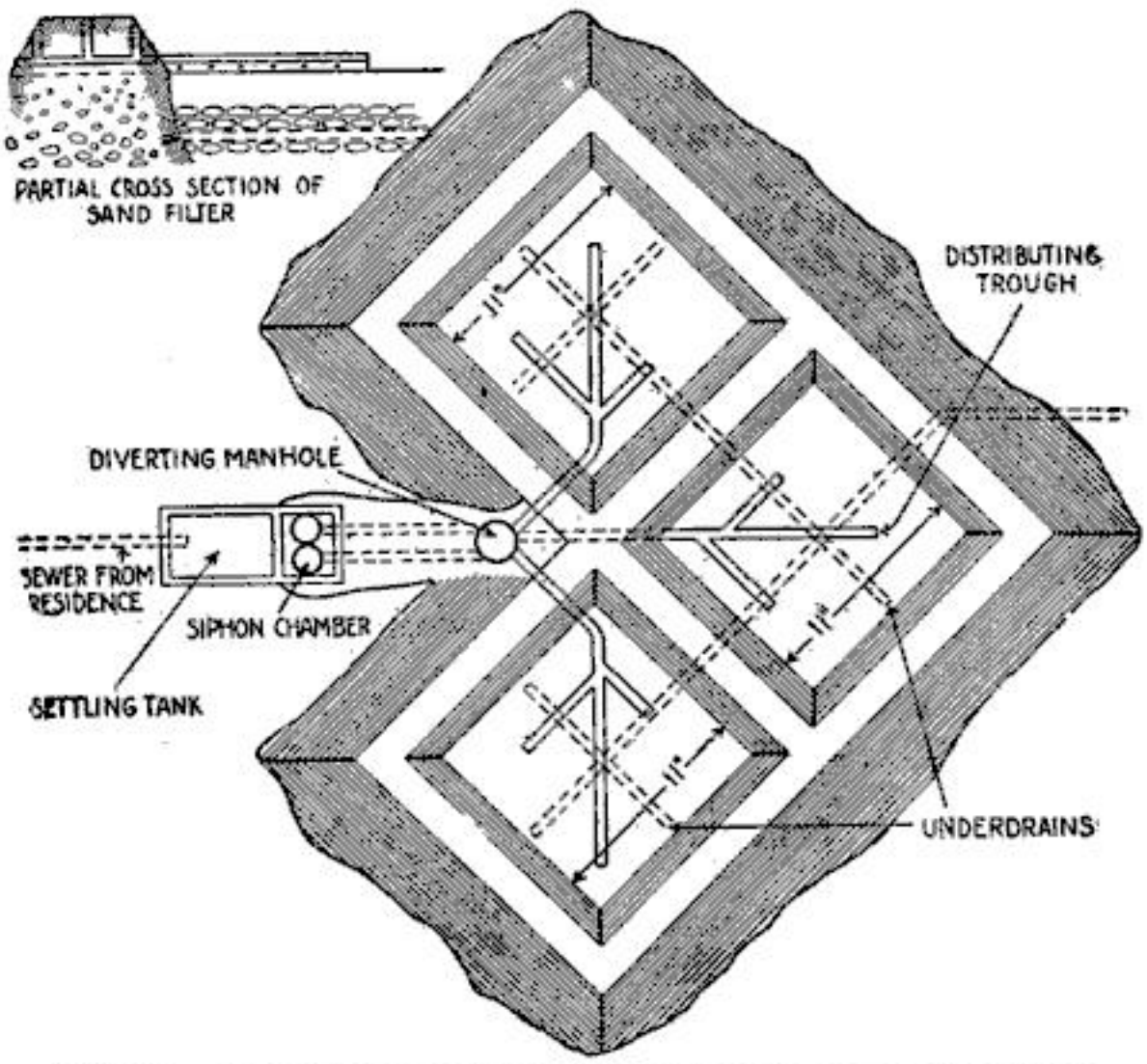


Fig. 8: A sand filter on a level area with embankments about two feet high that inclose the beds, in which one cubic yard of filtering material is used to each fifty gallons of sewage flow

Aeration of heavy soils can be effected by the use of coarse cinders or gravel laid in 12-in. to 16-in. layers in the bottom of the tile ditch with the top about 12 in. below the surface. The tiles are laid in these at the usual depth. Such an arrangement is shown in Fig. 6. The disposal tile should have a fall which does not exceed 1 in. in 50 ft., or the water will rush to the lower end and water-log the soil. The tiles are usually laid about ¼ in. apart and in rows about 15 ft. apart. The latter distance, however, will vary with the porosity of the soil. Where there is no subsurface drainage, artificial drainage

should be provided by means of tile drains laid below the sewage tile as shown in Fig. 7. In some cases an impervious stratum underlying the filter earth is underlain by a stratum of sand. Cases have been noted in which this impervious stratum has been broken by dynamite at 15 to 20-ft. intervals along the tile line, to provide natural drainage.

If surface disposal is not feasible, as when the soil is compact and nearly impervious, or is swampy making underdrainage hard to arrange, disposal by intermittent flow and filtration is necessary.

The sand filter usually is a bed of sand 3 to 4 ft. thick, which is fine on top and gradually increases in size to coarse gravel at the bottom. The sewage from the tank is distributed over the filter by means of tile laid loose-jointed over the surface in much the same manner as in the ground surface distribution system. The filter should be sufficiently porous and there should be sufficient natural or artificial underdrainage to allow every dose of sewage to sink away rapidly. Sewage should not stand on the surface of the filter for any length of time, as this soon destroys its purifying properties. About 45 sq. ft. of filter should be provided for each person served by the sewer. The area should be divided into from three to five beds so that each bed may be allowed to rest occasionally. A plan and a partial section of a sand filter for a family of eight persons is shown in Fig. 8.

In constructing a filter, a sufficient area should be leveled off and small earth embankments be made 18 in. to 2 ft. high to inclose the beds. The depth of the filtering material will depend largely on the porosity of the subsurface and the means of underdrainage, but it is well to have it not less than 2½ ft.; 3 to 5 ft. is better, but the depth should not exceed 6 ft. A good plan is to allow a minimum of a cu. yd. of filtering material for every 50 gal. of sewage flow.

Number persons.	Settling chamber.			Siphon Chamber.						Siphon diameter.
				Sand filter or heavy loam distribution.			Sandy or porous soil distribution.			
	Width inside.	Length inside.	Depth.	Width inside.	Length inside.	Minimum depth.	Width inside.	Length inside.	Minimum depth.	
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Ft. in.*	*Feet.*	*Feet*	*Ft. in.*	*Inches.*
6	4	6	3½	4	3	2 4	3	2	2 4	3
8	4	6½	4	4	4	2 4	3	2½	2 4	3
12	4	7	5	4	5	2 5	3	4	2 5	4
15	4	8	5	4	6	2 5	3	4	2 5	4
25	4	10	5	4	6½	3 2	3½	4	3 2	5
35	4½	12	5	4	6½	3 2	3½	4½	3 2	5

The above table is computed on the basis that the inlet and outlet of the settling chamber are placed with inverts twelve inches below the roof, making the sewage depth twelve inches less than the inside depth

Lighting an Alcohol Lamp with a Glass Rod

PLACE a quarter of a teaspoonful of permanganate of potash crystals in the bottom of a glass tumbler, moistening them with a few drops of water. Then, just barely cover the mixture with concentrated sulphuric acid—oil of vitriol. A very vigorous action will at once begin, and a glass rod dipped in the mixture, then touched to the wick of an alcohol lamp will immediately create a flame. The chemical action in the tumbler produces ozone, a concentrated form of oxygen, and the rapid oxidation of the alcohol in the wick brings it to its kindling temperature and lights the lamp.

A little ether poured on a glass plate can can also be ignited by simply touching it with the glass rod after the rod has been dipped in the tumbler. This experiment may be used to advantage by the house magician to fill out the program of an evening's entertainment.

To Prevent Mildew in a Damp Clothes Closet

THE careful housekeeper is often greatly troubled and perplexed by rust and mildew formations caused by damp closets. This state of affairs can be easily remedied if an earthenware bowl or a deep plate full of quicklime be placed in the closet. The lime absorbs the moisture, sweetening and disinfecting the damp corners. Rodents and insects that are likely to congregate in such places greatly dislike the odor of the lime. When the lime becomes slaked it should be thrown away and a fresh supply substituted.

Cleaning a Bowling Ball Quickly Without Injuring Its Surface

IT often requires much time and patience to keep the surfaces of bowling balls clean and round and smooth. One alley manager found this cleaning expense amounted to a considerable sum, so to reduce the time cost he devised the cleaning stand shown. It is not necessary to have such an elaborate stand as the one pictured, since the only requirement is a concave or semi-spherical depression turned in the end of a post or of a piece of wood, which is large enough to hold the balls securely and with a little larger circumference than that of the balls to be cleaned. Into the depression place a pad of steel wool of sufficient fineness to clean the balls without marring the surface. A ball placed in this and given a whirl or a few turns, will be quickly cleaned. Afterwards it should be rubbed with an old towel.

Place the steel wool in the cup, then turn the ball on it until the surface is clean

Almost every alley will have an old post used to set a ball in for the players. Such a post is just the thing, but if it is not available, one can be turned for the purpose. In turning a post be sure that the concave correctly fits the surface of the ball.—S. E. BURKETT.

A Primer for Carrying in a Motorcycle Tool Box

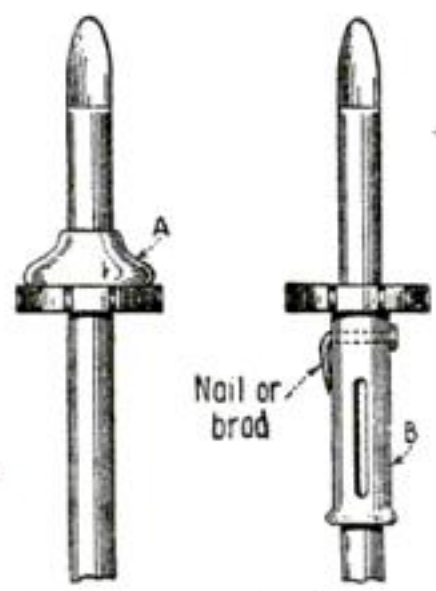
PRIMING devices are not always at hand for the motorcyclist, and on a cold morning trouble follows if a rich mixture cannot be drawn into the cylinder. While my method may be a very crude one, it has helped me in many instances. I procured a small vial or bottle of sufficient size for one charge. This, I used to catch the gasoline from the drip cock and to transfer it to the cylinder through a spark-plug hole. I keep the glass vial in a piece of pipe which is carefully corked on both ends to prevent possible breakage—LE CONTE TALLEY.

How to Make a Flashlight of Dazzling Brilliancy

AN excellent flash powder which produces a light of dazzling brilliancy, may be made by mixing equal quantities of magnesium dust and powdered chlorate of potash. Place the mixture on a piece of asbestos paper, and ignite it with a long wax taper. In a darkened room the suddenness and extreme brilliancy of the flash will dazzle everyone and produce a startling effect.

Supplying a Rib-Holding Piece to an Umbrella

AN umbrella-mender being without the proper fitting to replace the upper rib-holding portion, marked *A* in the illustration, searched through his kit until he found a lower section, *B*, that would fit the shank. As the portion of the shank under the upper rib-holding piece was rusty and somewhat thin, with a punch he easily drove a hole through it and the fitting at the same time. A nail was inserted and clinched. When the ribs were assembled the umbrella worked as well as usual.—JAMES M. KANE.



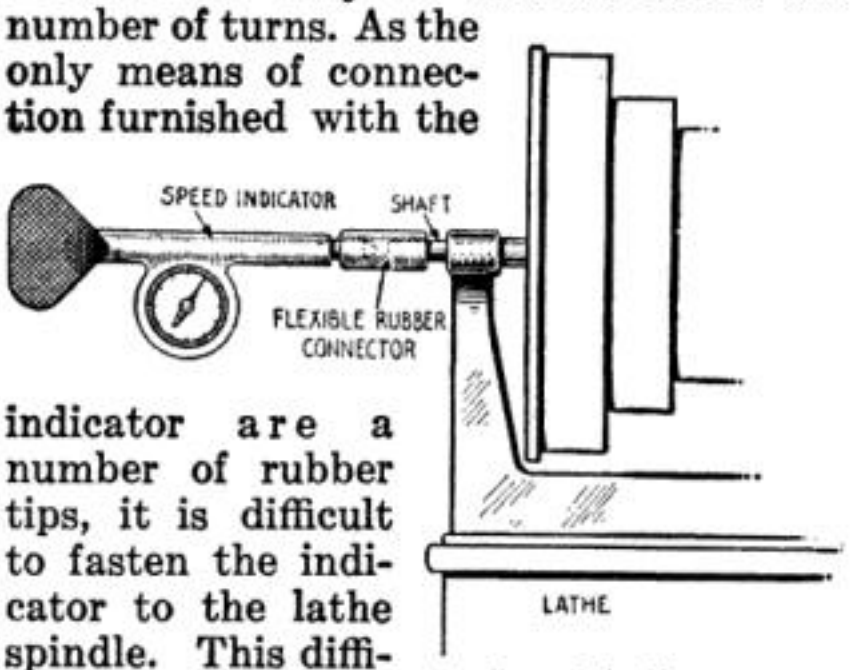
Changing umbrella parts to make necessary repairs

The Amateur Electrician

And Wireless Operator

A Speed Indicator Will Count the Turns for Your Coil

IN winding coils on a small lathe, a speed indicator may be used to count the number of turns. As the only means of connection furnished with the indicator are a number of rubber tips, it is difficult to fasten the indicator to the lathe spindle. This difficulty may be overcome by using a rubber tube as shown in the illustration. If the lathe spindle is too large, whittle a wooden plug with a peg on the end to fit in the hole.—EDWARD MCCLURE.



Speed indicator on a small lathe spindle

The Electro-Deposition of Copper on Insects and Flowers

MANY interesting specimens can be permanently preserved by the following process, which is both inexpensive and simple.

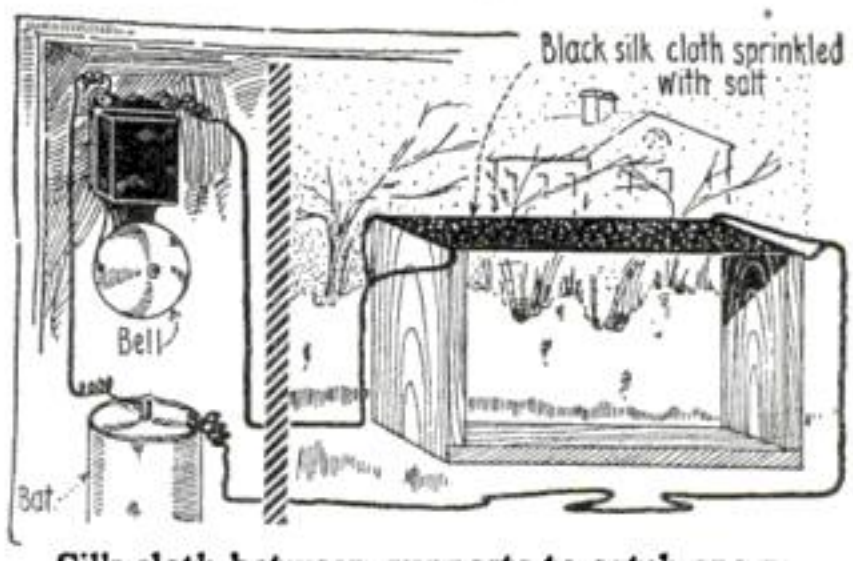
Melt together 110-115 grams each, of wax and deer's fat, and add 10 grams of phosphorus dissolved in a solution of 150 grams of carbon disulphide. Be careful to keep the phosphorus and carbon disulphide solution away from the flame, for the mixture is explosive.

When it has nearly cooled, stir it thoroughly and then pour it carefully through a glass tube, or preferably a glass funnel, under the surface of the fatty substance. The articles to be plated are attached to a wire and dipped in the mixture. Then they are given a bath in a solution of dilute nitrate of silver. When the silver turns black, the articles should be rinsed in water, and immersed in a weak chloride of gold solution, after which they are again washed. Now that they are coated with a film of gold, the articles are ready for the coppering solution.—HERMAN NEUHAUS.

An Electric Bell Signal to Indicate Falling Snow

WITH many square feet of sidewalk to keep free from snow, I have found the device illustrated, helpful to warn me of any unexpected snowfall during the night.

Between two upright boards, about 12 in. high by 6 in. wide, I suspended a piece of silk, connecting each end with a bell and battery in my bedroom. The silk is a non-conductor when dry, but when snow falls and wets it, the circuit is completed and the bell rings. To facilitate the melting of the snow the silk should be well sprinkled with common table salt.—F. E. BRIMMER.



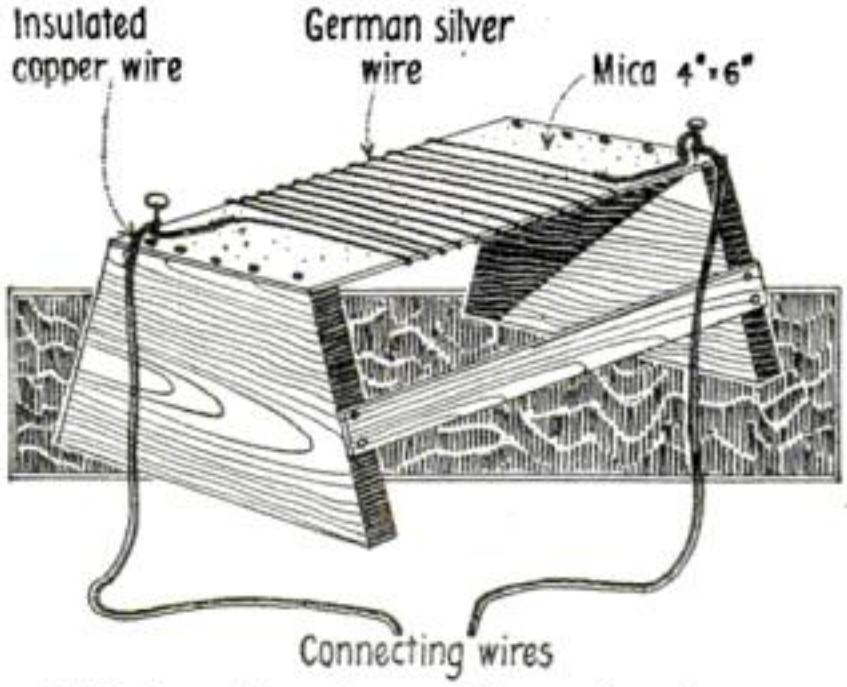
Silk cloth between supports to catch snow for making indoor electric connections

Making Silver Contact Points for a Spark Coil

A GOOD way to make contact points for almost any kind of instrument is explained as follows: Procure a piece of carbon, such as is used in dry batteries, and drill a hole in the center of it the size desired for the contact. This hole is then filled with small strips of silver, procurable at a jeweler's shop. After the hole is filled with the loose silver, the carbon is placed in a fire and heated until the strips are all melted into one piece. Then the carbon is cooled and broken away, leaving a rod of silver, the right size for the contact. Such contacts 5/32 in. in diameter have been in use on a 2-in. spark coil for some time and they give satisfactory results.—ODIS REYNOLDS.

Electric Toaster to Operate on Dry Batteries

THIS home-made toaster can be used where no electric light current from a power house is obtainable, by employing either dry or wet batteries. Take a piece



Heating element wound on mica for an electric stove to be run on battery current

of mica—isinglass from an old coal stove—and upon it wind about twelve turns of German silver wire. A good size for the mica plate will be 4 by 6 in.

To support the mica with its wire coil, cut out of ¼-in. hardwood, two pieces of the shape shown in the drawing, 8 in. wide at the base and 6 in. wide at the top. A height of about 3 in. will be right. These two pieces should be held 6 in. apart by means of two strips 6 in. long by 1 in. wide nailed on the ends. On the top, the mica is fastened with small tacks.

Drive medium sized nails into the wood at opposite corners of the mica plate, driving each only half way in. These will be convenient for holding the connecting wire. This should be insulated copper wire and should be connected with the German silver wire and to the batteries at either end.

When the current from two or more dry cells is turned on, the current will flow from the batteries, through the positive copper wire, through the German silver wire, back through the negative copper wire to the battery. The German silver wire has so much resistance that it will become red hot as the current passes. A slice of bread laid on the red hot wires will toast quickly. A trial test with the number of cells to be used will determine the size and length of wire that you will need.—F. E. BRIMMER.

German Wireless Plotting Muffled by Band Music

A GERMAN cruiser interned at Honolulu, relayed wireless messages from German agents in the United States to Japan, with the intention of embroiling the two countries in war. The wireless apparatus was worked while the ship's band played vigorously.

It appears that the former German Ambassador and his principal aids figured in the plot. The former German Consuls at Honolulu and Manila were also implicated. Both of these men pleaded guilty recently of participation in a plot to establish a revolutionary government in India.

A German secret agent, who was known by a number similar to a submarine, aided in the transmission of these messages, and advised the German government of the sailing time of vessels. The captain's diary reveals these secrets. After its discovery the captain was court-martialed and is now in solitary confinement pending his removal to Fort Douglas, Utah.

In February, 1917, the Cruiser Geier was set afire by her crew and badly damaged. The vessel was towed to the Pacific Coast for repairs.

Electrical Devices and How They Work

Principles of Electromagnets—III.

It is the flow of current through a conductor wound about a soft iron wire, that makes an electromagnet

By Peter J. M. Clute, B. E.

IT is evident that an electric current and a magnet exert a mutual force on each other. Since a magnetic field is a region in which a magnetic needle is acted upon by a force tending to turn it in some direction, it follows that the space surrounding a conductor, when an electric current is flowing through it, is a magnetic field.

Knowing from experiments the direction of current in the conductor, the following rule is deduced for the direction of the lines of force around the wire:

If you grasp the conductor with the right hand, with the extended thumb pointing in the direction of the current, the lines of force will be around the conductor in the direction of the fingers, as shown in Fig. 1.

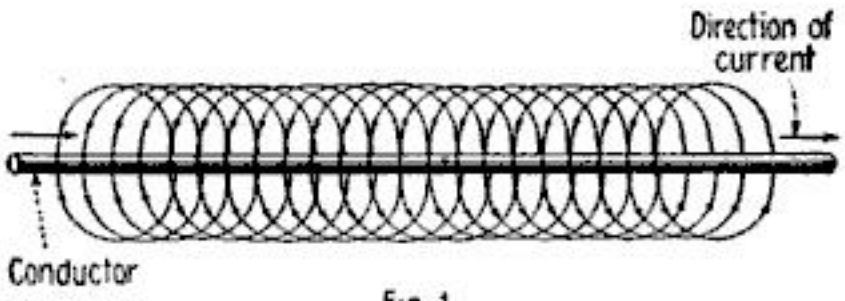


Fig. 1

The lines of force will be around the conductor in the direction shown by the coil

The direction of the lines of force around a conductor is more clearly shown by the arrows in Fig. 2, where it is assumed that the current in the wire is flowing toward the observer. Reversing the direction of the current causes the lines of force around the conductor to be reversed.

If a current-carrying conductor is bent in the form of a loop, as in Fig. 3, all the lines of force surrounding the conductor pass through the loop in the same direction. Any magnetic substance placed in front of the loop tends to place itself with its longest axis projecting into the loop, in the direction of the magnetic force.

By forming a helix of the conductor, the lines of force around and inside each loop will be similar, forming an equivalent of long lines of force threading through the entire helix.

The appearance of the magnetic field around a helix through which a current is flowing, is illustrated below in Fig. 4.

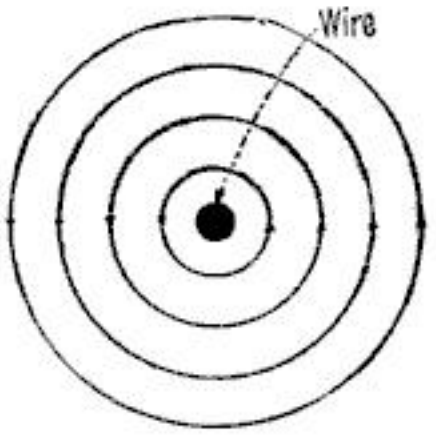


Fig. 2

The direction of the lines of force are shown by arrows

A helix containing a number of turns through which current flows is called a solenoid. The polarity of a solenoid, or the direction of the lines of force through it, depends on the direction of the current in the conductor.

The polarity of a solenoid may be determined by the following rule: Looking at the end of the helix, if the current flows around it clockwise, that end will be a south pole; if in the other direction, it will be a north pole.

When a magnetic substance, such as iron, is placed in a magnetic field, so that the magnetic lines of force can reach it, the substance immediately becomes magnetic. The lines of force appear to crowd together and tend to pass through the

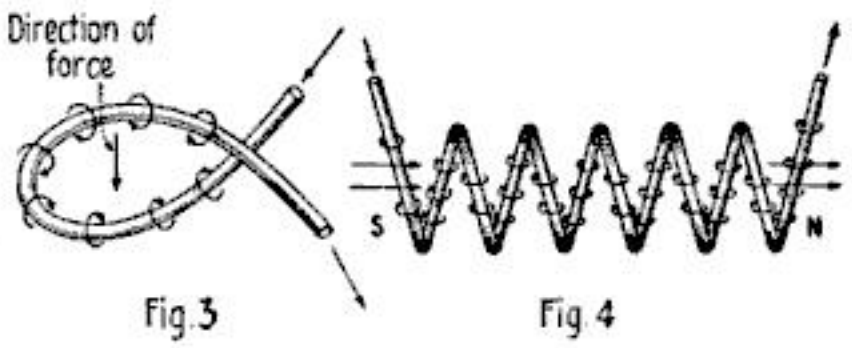


Fig. 3 Fig. 4

Showing the direction of the lines of force in a loop or through a helix through which a current of electricity is flowing

substance. While under the influence of the magnetic field, it behaves like a magnet, and has polarity, the same as for a solenoid. A magnet, so produced, is termed an electromagnet; and the mag-

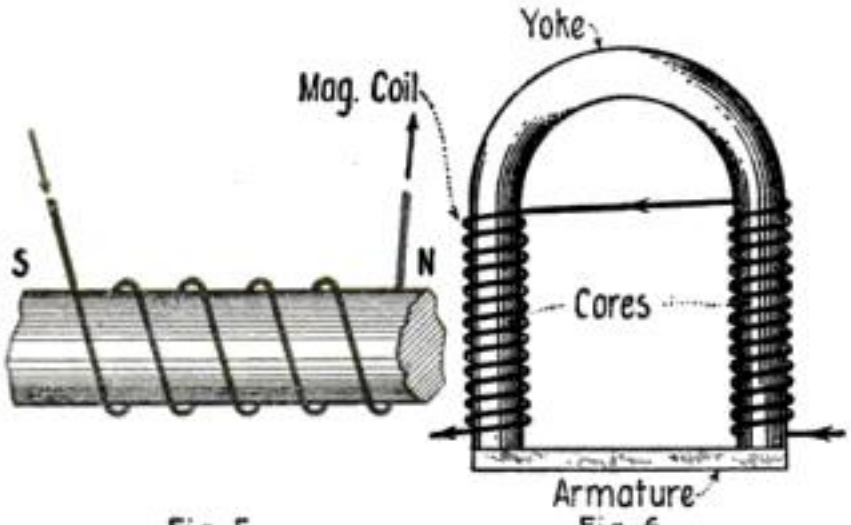


Fig. 5 Fig. 6

An iron bar encircled by a current is a core, and in a U-shape forms an electromagnet

netic substance (soft iron), around which the current circulates, is called the core—see Fig. 5. The magnetizing coil usually consists of a large number of turns of insulated wire.

Electromagnets differ from permanent magnets in several particulars: 1. They are made of soft iron instead of steel; 2. The magnetizing force is an electric current, and not another magnet; 3. The magnetic properties exist only while current flows in the magnetizing coil; 4. The magnetic strength is variable, approximately proportional to the current flowing; 5. The polarity changes with change

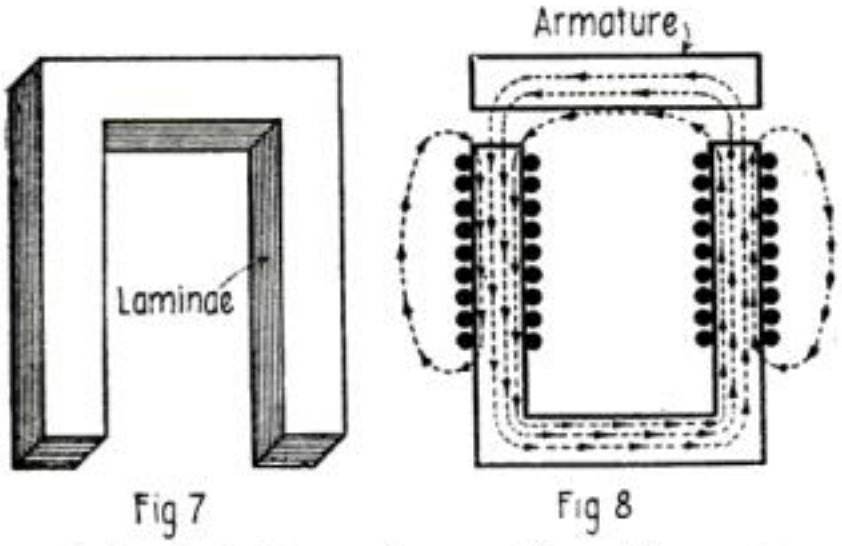


Fig 7 Fig 8

A laminated core for an alternating current and the coils surrounding a core with lines of force about a magnetic circuit

in the direction of the current, and hence can be instantly reversed.

A typical form of electromagnet is illustrated in Fig. 6. On each of the legs of a horseshoe-shaped core is wound a cylindrical coil of insulated wire. The coils are so connected that current flows in opposite directions around the two legs of the magnet, making one end a north pole, and the other a south pole. When the soft iron armature is placed across the two poles, a closed iron circuit is obtained, and if the armature is large enough, most of the magnetic induction will be in the iron, since the lines of force will be closed curves. The number of lines of force produced in the core of an electromagnet may be considered as due to the relation of two factors, the magnetizing power of the current in the magnet coils, called the magnetomotive force, and the resistance to magnetization offered by the iron core, its reluctance, or

$$\text{Magnetic flux} = \frac{\text{Magnetomotive force}}{\text{Reluctance of core.}}$$

The magnetomotive force is produced by current circulating in the coil and so far as magnetism is concerned it does not matter whether 100 amperes of current flow once around the bar or whether one ampere circulates 100 times. The magnetizing force is always proportional to the product of number of turns and the current flowing in the coil. This product is known as ampere turns.

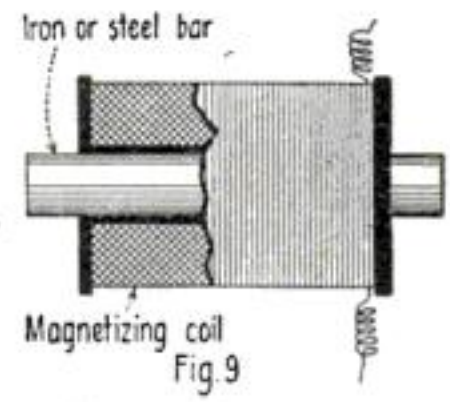


Fig. 9

Conventional form of an electromagnet

The magnetic reluctance varies with the material used as core. It is practically greatest with air and least with well annealed wrought iron. It also varies in inverse proportion to the cross-section of the core. The above is rigidly true for air and approximately true, within certain limits, for iron.

The cores for alternating current magnets must be laminated. A laminated core is made up of a number of thin plates, as shown in Fig. 7. The core is built in this way, as otherwise current would be induced in the iron and this current would heat the core and cause considerable waste of energy.

In designing electromagnets, it must always be borne in mind that the attraction of an electromagnet for its armature varies as the square of the number of

lines of force passing through both, and it should then be endeavored to obtain the maximum flux that a current can produce; that is, to arrange a circuit with the least possible magnetic resistance.

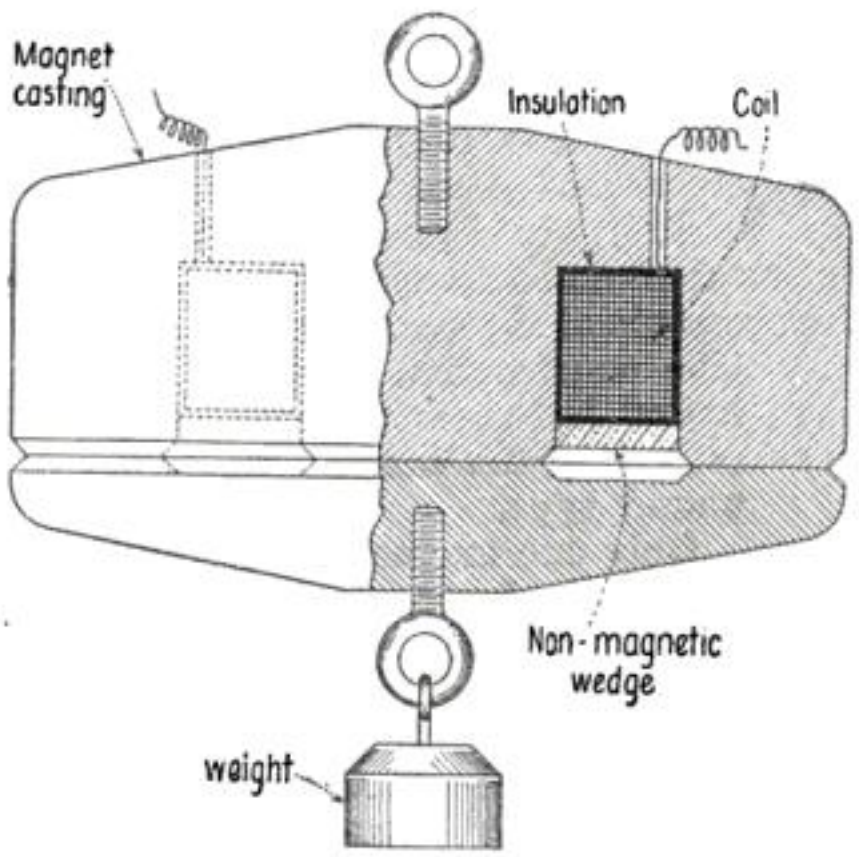


Fig. 10

General form of a large iron-clad lifting-magnet used with a crane or lift for a hoist

As a general rule, it will be found advisable to make the thickness of the coil about equal to that of the core; to make the yoke just long enough so that the coils will not interfere with each other when placed in position; and to make the core long enough to accommodate the necessary wire. In all coil winding proper insulation must be provided to prevent a short circuit. The kind of insulation depends on the size and use of a magnet.

In Fig. 8 is shown a cross-section of an electromagnet, showing the coils surrounding the core and a general scheme of the lines of force existing in such a magnetic circuit. The armature is shown out of contact with the magnet and considerable leakage flux is depicted. If the armature is brought into contact with the core, it will not only reduce this leakage, but it will increase the flux of the magnet by lowering the magnetic reluctance of the circuit.

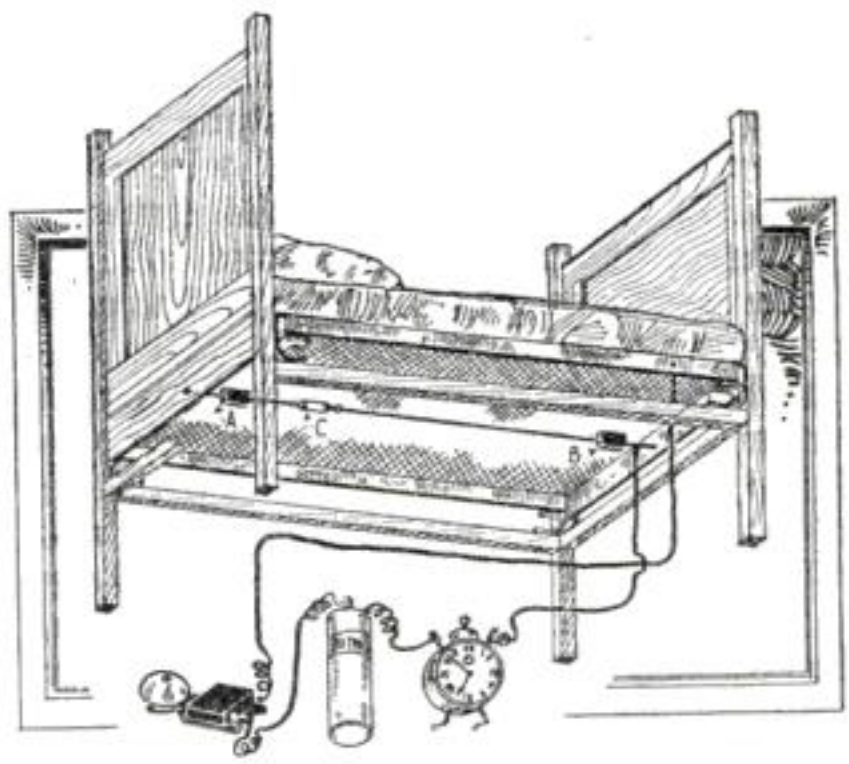
A few of the principal forms of electromagnets, including the horseshoe magnet, the electro-bar magnet, and the iron-clad magnet are shown in Fig. 6, 9 and 10.

The Sleeper Must Get Up to Stop the Alarm

THE growing habit of switching off the alarm clock and then sleeping a while longer made one commuter miss his train many times. He very easily overcame this difficulty, however, by making an attachment to his bed springs, as shown in the illustration, that compelled him to get up to break the electric current.

A simple frame was made of two brass spring pieces, stretched lengthwise of the bed, one on each side and just under the springs, with a third piece connecting them about 2 ft. from the head. These wires were properly insulated from the bed frame with pieces of fiber attached in the line as shown at *A* and *B*. A small turnbuckle *C* was used to keep the line taut.

A cheap clock made the electric connection at the time set, and a couple of dry batteries completed the device. The connections were simple, one wire was attached from the battery, through the bell to the bed springs, the other from the battery, through the clock to the insulated frame. The clock turned on the current at the time set. The weight of the sleeper caused the springs to touch the frame, as shown by the dotted line, so the bell rang and kept on ringing until he got up.—J. K. BURRELL.



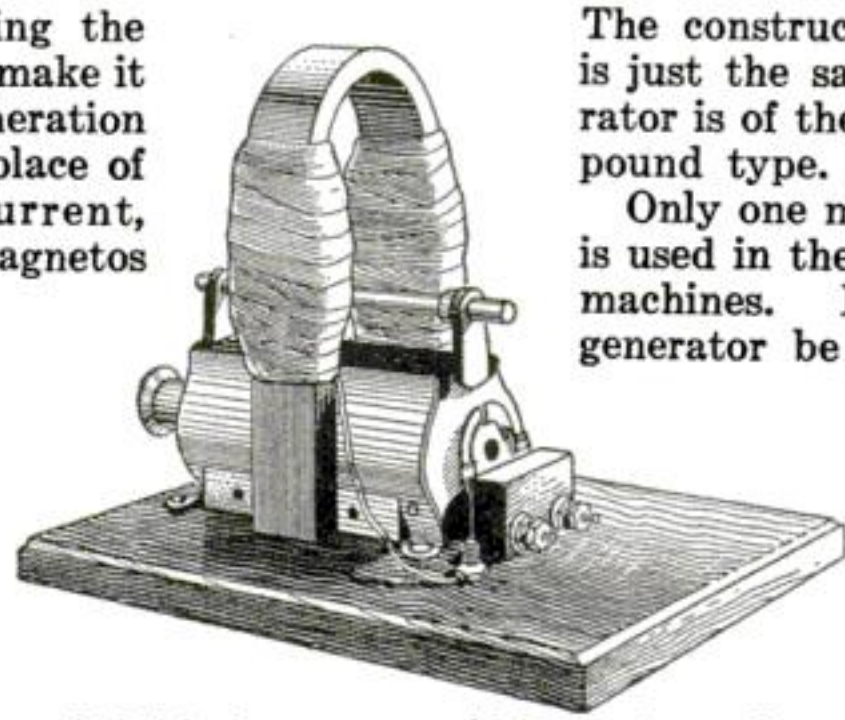
The weight of the sleeper makes the contact for the circuit on the bed springs

Making Small Generators from Telephone Magnetos

THE amateur electrician may construct very sturdy little direct current generators of either series, shunt or compound type from the parts available in an old telephone magneto which may be procured for a few cents from nearly any telephone exchange, especially in the rural districts. It does not matter whether the magneto is in a workable condition or not, providing the parts are all intact.

The first operation must be that of properly reconstructing the armature in order to make it adaptable for the generation of direct current in place of the alternating current, which telephone magnetos produce. First remove the fine wire which is wound upon the armature and replace it by winding each pole of the armature full of No. 22 single cotton covered wire. It is very necessary that both poles be wound in the same direction as shown in Fig. 1. It is of course, understood by amateur electricians that the smaller the wire contained on the armature of the dynamo the higher the voltage generated will be, with a corresponding decrease in the amperage. Telephone magnetos are designed to generate a potential of several hundred volts in order to overcome the high resistance of the line. This high voltage and low current value is not suitable for practical purposes, especially in the amateur's workshop. Hence, the necessity of changing the small wire on the armature to that of a larger size.

As the armature is a two-pole affair, the commutator will need but two segments. The commutator will be of the disk type as it is very simple to make and possesses certain advantages over the drum type which make it more adaptable for this purpose. Owing to the hollow shaft of the armature, which is used to bring the leads to the cummutator, it will be found rather difficult to fit a drum commutator to it. The details of the small disk commutator are shown in Fig. 2. The copper segments are fastened to the fiber disks by means of small brass brads used as rivets. The brads should be filed perfectly flush with the surface of the copper segments after being hammered into place. The hole in the center of the fiber disks should be a trifle smaller than the shaft so it can be forced on the shaft and made to remain rigidly in place. After the two leads from the winding are brought through the hollow shaft and soldered to the segments, the armature of the machine is completed.



A finished generator which can be made from parts of an old telephone magneto

The construction of the armature is just the same whether the generator is of the shunt, series or compound type.

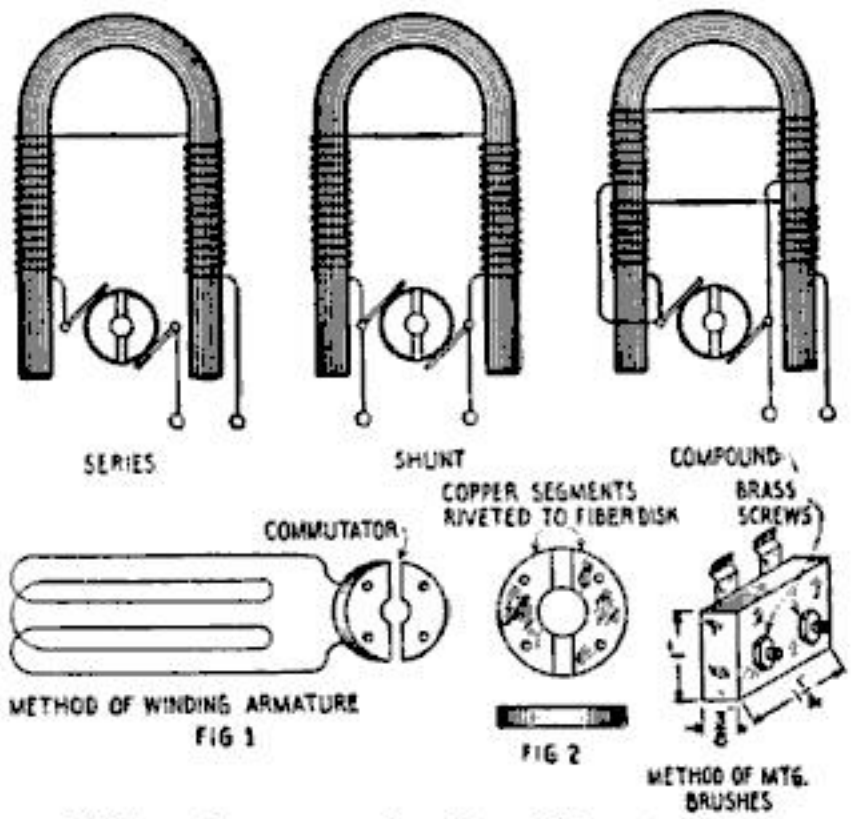
Only one magnet of the magneto is used in the construction of these machines. If a more powerful generator be desired, two magnets may be used. In fact, the three magnets may be used together without any winding at all by merely taking the current off the commutator with two small brushes. The writer would advise, however, that either one or two magnets be used with a field winding. Aside from giving the mechanic a better understanding in dynamo construction, the types with field winding possess certain advantages over those without it. If the mechanic wishes a series wound machine, the field coils should be wound with No. 24 single cotton covered copper wire. A little more than ¼ lb. will be needed. Paper is first wound around the magnet to insulate it from the wire. It is not necessary to wind the wire on carefully or to make bobbin heads to hold it in place. It is essential, however, to have approximately the same amount of wire on each pole. It is also necessary to wind each field coil in the same direction. After the field coils are wound, they are given a coat of shellac and covered with friction tape, leaving the leads protruding for connections. It is also desirable to shellac the tape after it is wound on to make the winding as nearly moisture proof as possible.

The machine is now ready to be fitted with brushes. The brush system described as follows, like the armature, can be used on any type of machine—series, shunt or compound. The brushes are made from very thin sheet copper bent as shown in the sketch. They are mounted on a small fiber or hard wood block of the dimensions shown. Small brass machine screws hold them in place and also provide means for connections. Care should be taken in adjusting the brushes so they bear flatly upon the commutator surface which reduces the resistance of the sliding contact to a minimum.

After mounting the apparatus on a suitable base, the connections of the various parts are made as illustrated. It will be seen that the field winding is connected in a series with the armature, which fact gives the dynamo its name. An empty thread spool is forced on the end of the shaft to serve as a driving pulley. The dynamo may be driven by a water motor, gas engine or other means. If the experimenter has alternating lighting current available, a small 110 volt motor may be used to drive the generator. In this case, it makes an ideal motor generator for use on the experimenter's table for electrolysis, etc. A series wound dynamo, however, should never be employed to charge a storage battery as it is very likely to change its polarity and injure the cell.

To build a shunt wound dynamo, it is necessary to make a different field winding. The field winding of a shunt wound dynamo should have a much higher resistance than the armature winding so that it will have sufficient magnetizing power without drawing too much current. In this case, No. 30 single cotton covered copper wire should be used for the field coils. About ½ lb. is the amount needed. It is wound on in the same way, the only difference being that it is connected in shunt to the armature instead of in series with it. The method of connecting a shunt wound dynamo is shown in the sketch. This machine is ideal for charging storage batteries.

Compound wound dynamos are provided with two separate field windings. One winding, which is of fine wire, is connected in shunt across the brushes, while the other winding, which is of larger wire, is connected in series with the armature winding. The connections are plainly shown in the sketch. The fine wire should be wound on first and consists of ⅜ lb. of No. 30 single cotton covered wire divided equally between the two poles. After being given a coat of shellac, a layer of paper is placed over the winding. The second winding, which consists of ⅜ lb. of No. 18 single cotton covered wire, is then wound over the first. After being shellacked, it is covered with friction tape and the machine is assembled.



Wiring diagrams for the different fields; also the method of winding the armature

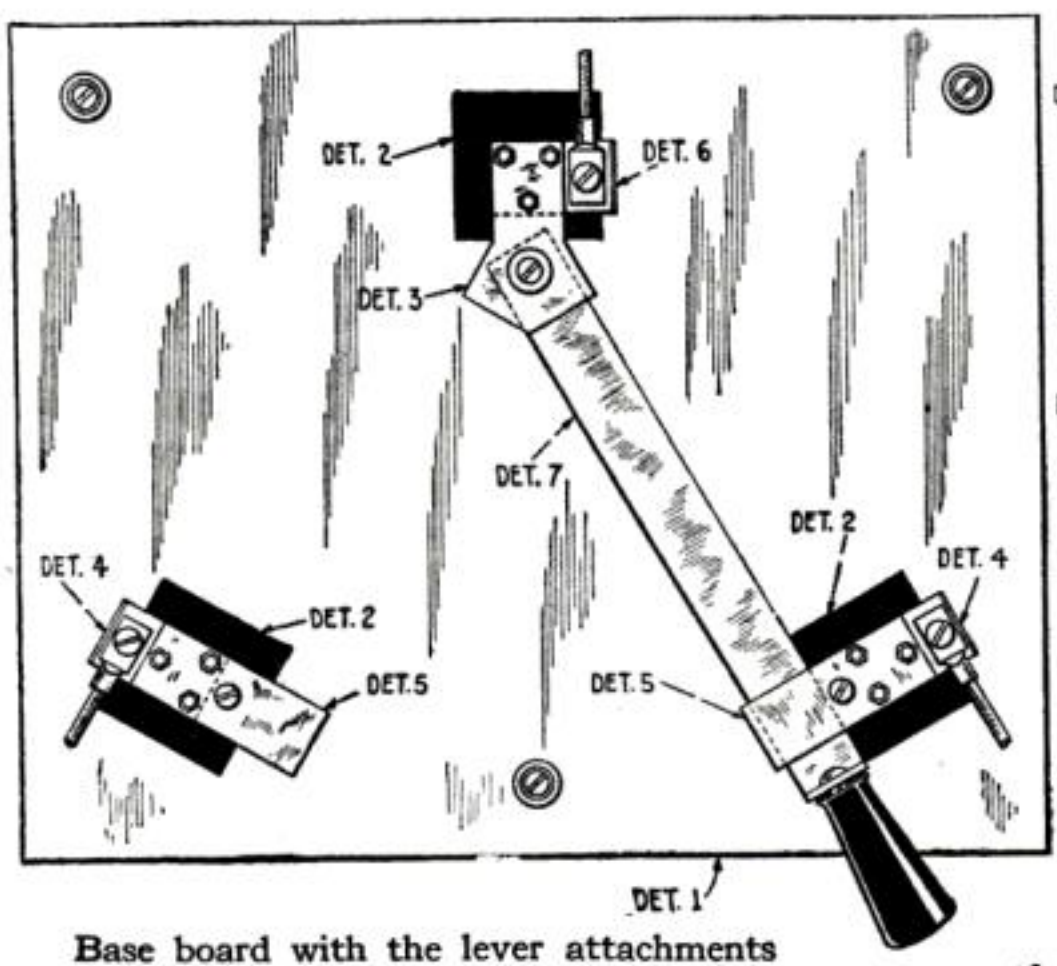
A very good universal generator can be made by winding each one of the three magnets furnished with the magneto. One can be wound for a series dynamo, one for shunt and one for compound. The experimenter will then have a machine of any type by using the corresponding magnet over the armature. It is not necessary to arrange any mechanical contrivance to hold the different magnets in place as they generally fit tightly over the sheet iron frame that covers the armature. It will be necessary, of course, to use the proper connections for each different magnet.

These small generators, if properly constructed, should deliver from 20 to 30 watts of energy. This will depend largely upon the strength of the magnets.

An Improved Design for a Grounding Switch

THIS article describes a short-throw lightning switch having the base of marble, and the contact supporting blocks of bakelite. Bakelite is a perfect insulator, marble is not. Marble is cheap, bakelite is not. The combination gives maximum insulation at minimum cost.

Raising the contacts from the marble eliminates surface leakage to a large extent. By having the contacts mounted



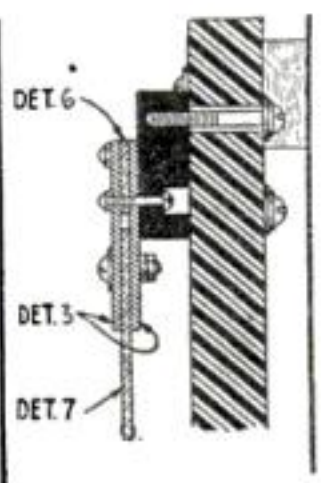
Base board with the lever attachments for the single throw switch

with their flat sides in contact with the supporting blocks, alinement becomes automatic, because bakelite sheet is extremely accurate in thickness. By placing the contacts at the vertices of an equilateral triangle, minimum throw with maximum space between contacts is secured.

A summary of the material required is as follows:

Marble, 1 Pc. 1 in. x 11½ in. x 14 in.
Bakelite Sheet ¾ in. Thick, 3 Pcs. 2 in. x 2 in. x ¾ in.
Bus Bar Copper, 1 Pc. ⅛ in. x 1 in. x 25 in.
Copper Sheet ⅛ in. thick, 1 Pc. 2 in. x 3 in.
5/16 in.-18 x 1½ in. Rd. Hd. Iron Cap Screws, 9 Req.
¼ in. x 2¼ in. Rd. Hd. Iron Wood Screws, 3 Req.
No. 10-32 x 13/16 Fil. Hd. Brass Mach. Screws, 9 Req.
No. 10-32 Brass Acorn Nuts, 9 Req.
No. 10-32 x ⅜ in. Fil. Hd. Brass Mach. Sc., 3 Req.
No. 14-20 x ½ in. Rd. Hd. Brass Mach, Sc., 3 Req.
No. 14-20 x ¾ in. Rd. Brass Mach, Sc., 1 Req.
No. 14-20 Hex. Brass Nuts, 8 Req.
5/16 in. Iron Washers, 9 Req.
¼ in. Brass Washers, 3 Req.
No. 10 Small Pattern Brass Washers, 9 Req.
Felt Washers with 5/16 in. Center Hole, 9 Req.
Felt Washers with ¼ in. Center Hole, 3 Req.
3 100 Amp. Terminals.
1 Handle.
Wooden Blocks ⅝ in. x 1½ in. x 1½ in., 3 Req.

The switch can be made by the average amateur with ordinary tools. Get a piece of unpolished white marble for the base, from some marble setter or stone cutter, and chip it to size with an ordinary cold chisel; taking small "bites," so as not to crack it. Smooth up the edges with an ordinary coarse rasp, and finish them off with coarse emery cloth. Clean up the top surface with coarse emery, also, and file a bevel all around.



As your next step drill the base as per detail 1. This takes time, patience and labor. Drill the holes with an ordinary twist drill, using plenty of water as a lubricant. As the drawing shows, there are nine 5/16 in. holes for fastening the bakelite blocks to the base, and three ¼-in. holes to fasten the base to the wall or support. Be sure to drill all holes from one side, as the drill always chips out a small piece of marble around the hole when it breaks through.

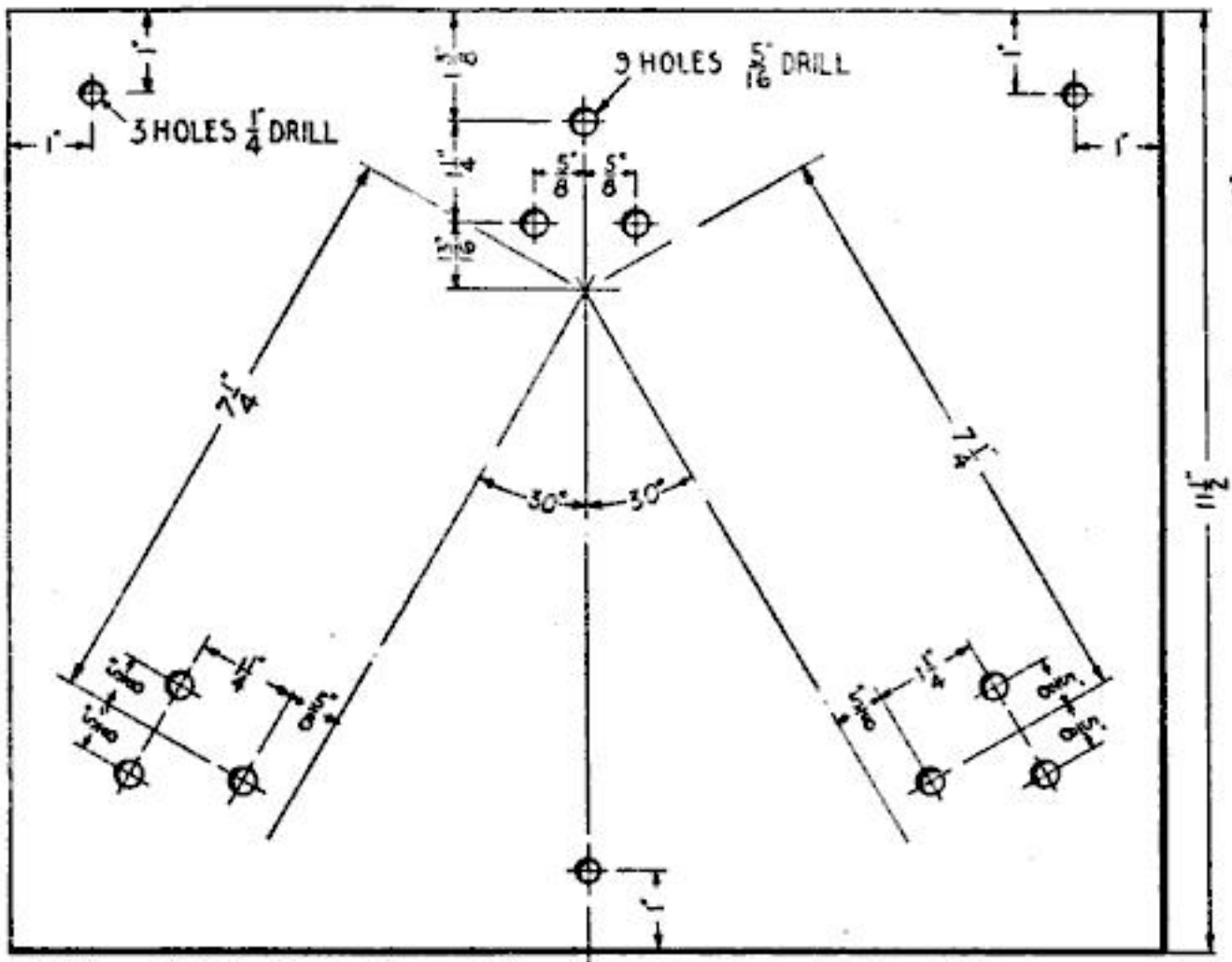
There are required three insulating blocks, 2 in. square, made out of ¾-in. sheet bakelite. You should be able to get the bakelite from any up-to-date dealer in wireless supplies. Bakelite is the best insulation for this purpose, as it weathers well, does not warp, and does not decompose with age. Cut the bakelite with a hack saw, file the edges smooth and polish it with a fine emery cloth and oil. Drill and tap it as shown in detail 2.

Four jaw clips are needed, two for the bottom and two for the top. Use bus bar copper 1 in. wide by ⅛ in. thick. Cut this to length with a hack saw, file the edges smooth, and file a bevel on one end, so that the blade of the switch will enter the jaw clips smoothly. After filing the bevel, drill the clips as per detail 5.

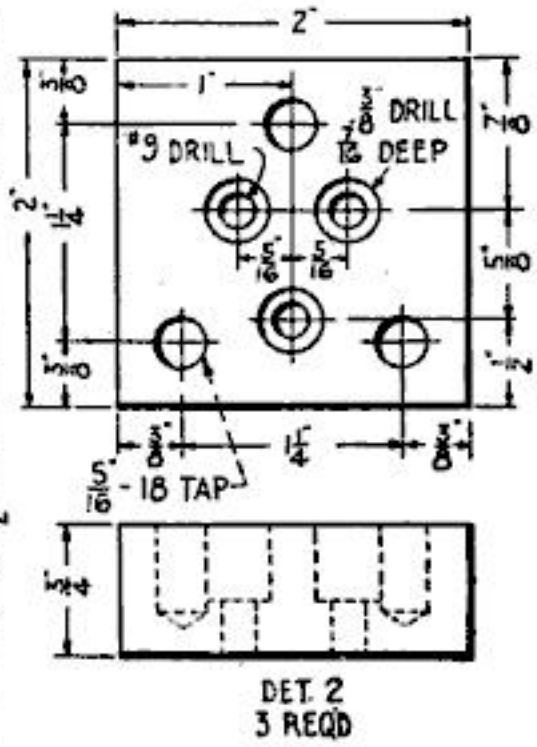
The two jaw clip spacers, and one hinge clip spacer, are also made from bus bar copper. Cut them to length, file the edges, and bend up one end in a vise. Drill the jaw clip spacers as in detail 4 and the hinge clip spacer as in detail 6.

Get some sheet copper 1/8 in. thick, and draw an outline of the hinge clip upon it as shown in detail 3. Cut around it with a hack saw, finish it with a file, and drill it as indicated.

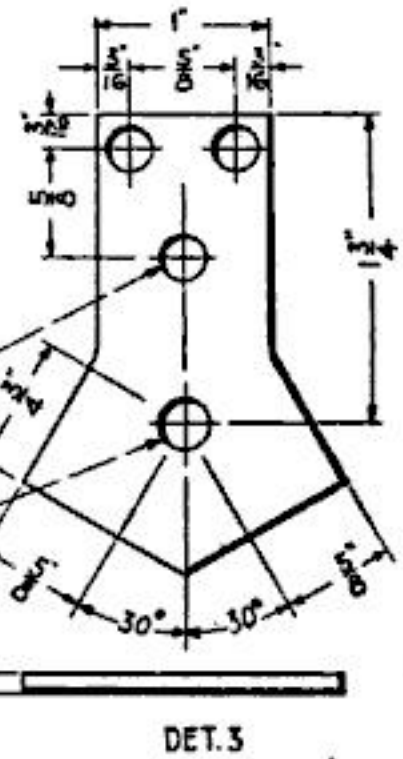
As shown in detail 7, cut off a piece of bus bar copper for the blade, 9 1/4 in. long, and drill a 17/64-in. hole 3/8 in. from one



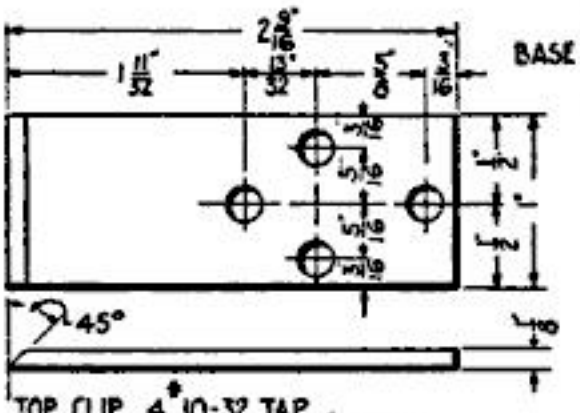
DET. 1
BASE 1" MARBLE



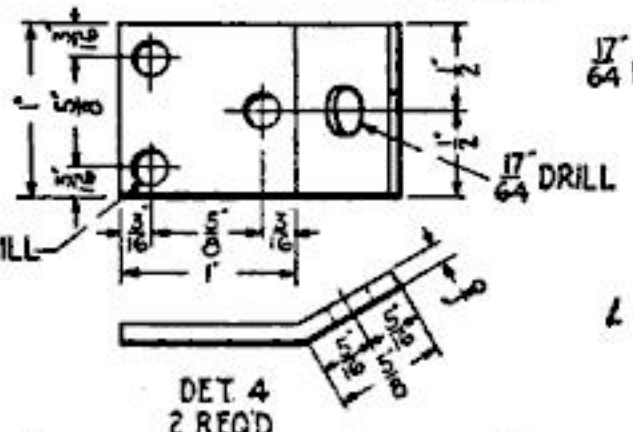
DET. 2
3 REQ'D



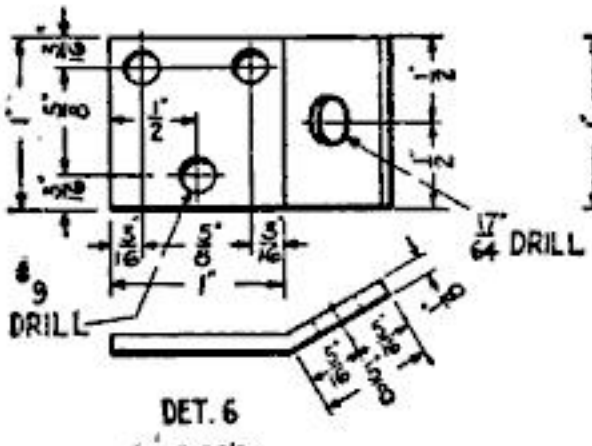
DET. 3
1 TOP & 1 BOTTOM REQ'D



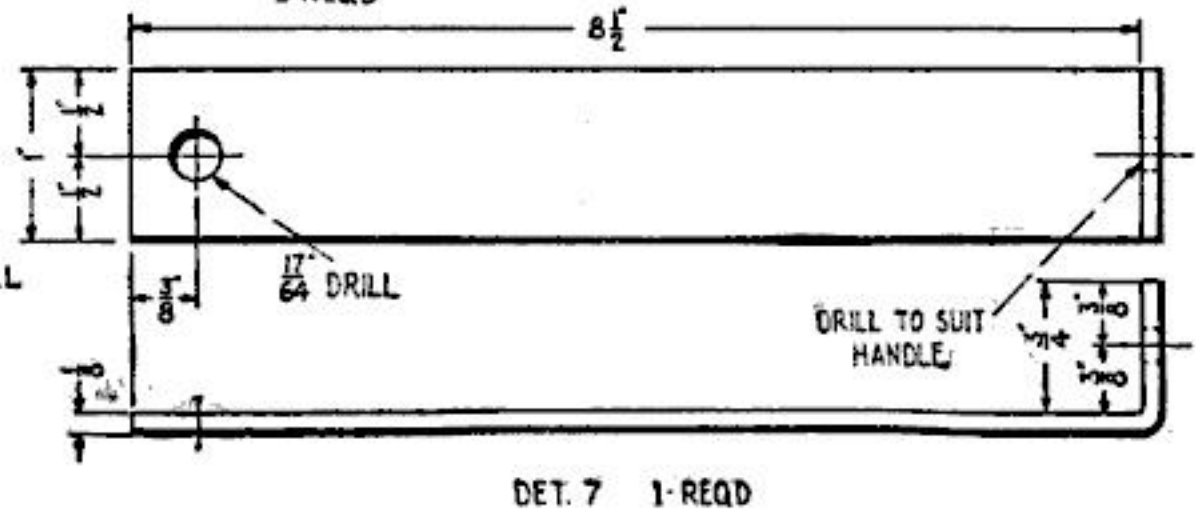
TOP CLIP. 4 #10-32 TAP
BOTTOM CLIP 4 HOLES #9 DRILL
DET. 5
2 TOP & 2 BOTTOM REQ'D.



DET. 4
2 REQ'D



DET. 6
1 REQ'D



DET. 7 1 REQ'D

Details of the parts that enter into the construction of a grounding, single throw switch in which their combination gives a maximum insulation efficiency at a minimum cost

end. Make a right angle bend at the other end ¾ in. long, and drill it to take the handle. The handle should be large and substantial. It is best to buy it from some supply house.

Now you are ready to assemble the jaw clips. Clean all the clips and the blade with fine emery cloth before assembling. Lay the bottom clip in position on the bakelite block; next the spacer and then the top clip. Fasten all three securely to the block by means of three No. 10/32 machine screws, and lock the screws with acorn nuts. Assemble the screw which acts as a stop for the blade, and pinch the ends of the clips together, so the jaws will grip the blade firmly. The hinge clip is assembled in a similar manner. Fasten all three blocks to the marble base with the 5/16-in.-18 screws. Put a brass washer and a felt washer on each screw, in the order named, before assembling. Fasten the blade in the hinge clip with a ¼-in.-20 brass screw, and lock it with a ¼-in.-20 brass nut.

The next thing to do is to mount the switch. If you mount it in an exposed position, protect it with a weatherproof box. Place the switch so that the hinge clip is uppermost; and fasten the aerial wire to this. The lead-in to the apparatus and a No. 4 ground wire go to the two jaw clips respectively. Space the switch from the wall or support upon which you mount it, by means of three wooden blocks, about 1½ in. by 1½ in. and 1 in. thick. Drill a ¼-in. hole in each of the blocks; pass the three mounting screws through these and the base, turn them up tightly, and your switch is then ready for use.—W. H. SCHEER, JR.

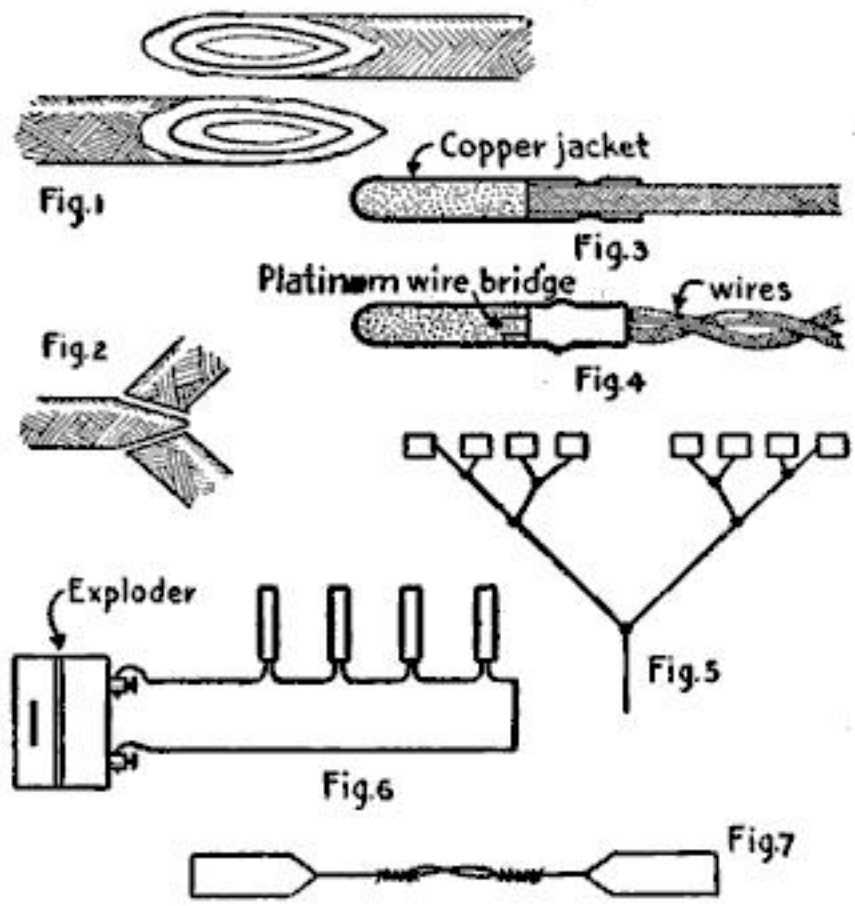
Killing Woodchucks with Deadly Dynamite Fumes

WOODCHUCKS may be easily exterminated by the slow burning of dynamite in the burrows. The kind of dynamite to use is the low grade ammonia. A stick of this, well saturated with kerosene, will smolder and give off a deadly gas, which when confined in the burrows, will asphyxiate any of the animals contained in them. After placing and igniting the stick, cover up the entrance to the hole tightly so that no air can penetrate or gas escape.

A Few Tips on Splicing Fuse for Discharging Dynamite

THE proper way to cut a fuse in order to splice it to another piece of the same kind or to splice a fast burning fuse to one that is slow burning is shown in Fig. 1. The fast burning fuse is usually fastened in the cap or detonator. The powder surfaces are placed together and lashed tight.

The proper way of slicing the fuse when two charges are to be exploded simultaneously from one main fuse is shown in Fig. 2. The diagonal cuts are used to



Splicing fuse to ignite a charge of dynamite. Double splices for branches in fuse line

give greater powder surface and to insure the fire traveling from one piece to the other.

The detonator cap for a powder fuse is shown in Fig. 3. Fig. 4 shows the detonator cap for an electric exploder, while Fig. 5 shows the method of splicing fuses which simultaneously explode several charges—each dot in the drawing indicating a splice.

A method of connecting the charges when they are to be fired with an electric exploder is shown in Fig. 6. All wires are securely fastened to the charge to which they are attached and the ends are spliced together as shown in Fig. 7. The lead-in wires should never be connected with the exploder until everything is ready for the shot.—GEO. M. PETERSEN.

Wireless Work in Wartime

VIII: The Power Circuits of the Transmitter

By John L. Hogan, Jr.

IN last month's article a general review of the technical fundamentals of radio communication systems was given. The two basic methods of producing alternating current were described in brief, and two types of radio transmitter were shown. All this was preliminary to this second group of articles, which will include six monthly instalments devoted to telegraphing.

Since large numbers of skilled operators are and will be needed by the Naval and War Department radio services, and since the more familiar these men are with the practical and technical basis of radio apparatus and design, the more useful they will be, this new group of articles will continue to point out various successful arrangements of radio apparatus and the best ways of handling them.

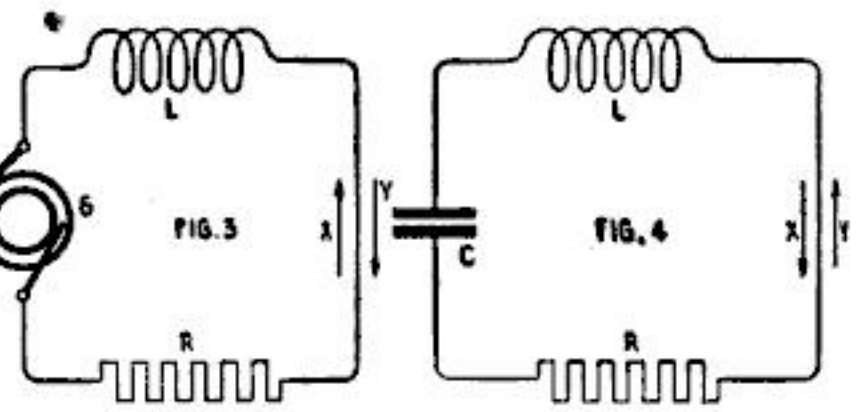


Fig. 30.—Radio transmitters which produce wave-groups in this way are of the damped wave type

Classification of Transmitters

Detailed attention must first be given to the transmitter. Each sending apparatus for radio telegraphy may be classified into one of two main groups, according to the type of wave emitted from the aerial system. If power is applied intermittently to a condenser, which is first charged to a high potential and then allowed to discharge with oscillations through an inductive circuit (as shown in Fig. 30, reproduced from last month's article), there are produced currents which more or less rapidly die away in maximum amplitude. The application of these currents to a radiating aerial system, when the circuit constants are adjusted to produce alternations at extremely high (or *radio*) frequencies, results in the emission of groups of waves. The amplitude or intensity of the alternations in these groups of waves dies away in accordance with the current-groups which produce them. Radio transmitters which produce wave-groups in this way, one for each charge-and-discharge of the condenser, are of the damped wave type, which we may call Class I. This class includes practically all of the numerous variations of spark and buzzer sending arrangements; and the class may be subdivided by reason of the particular characteristics of each form of spark transmitter.

When waves are generated by means of an apparatus which supplies power to the aerial system as fast as it is radiated, so that the waves never die away, there are no wave-groups produced. Energy is sent off into the ether continuously, and the amplitude remains practically constant as long as the transmitter is in operation. Such senders, which include the radio-frequency alternators and arc transmitters, are of the undamped or sustained wave type, which may be called Class II. As with Class I, there are many different sorts of instruments which give this same general result and which may be made the basis of sub-groups under the main classification of undamped or continuous wave senders.

The damped wave transmitters are used far more than the undamped wave type at the present time. They are particularly suitable for short wave transmission. Speaking broadly, the undamped wave is superior to the damped wave for any type of service, but suitable sending instruments for generating the short undamped waves preferred for short distances have only recently been developed. Consequently, by far the greater number of ship stations, as well as of shore stations used for small or moderate

distances, are of the damped wave classification. It will be best, therefore, first to consider the damped wave transmitters in detail.

The Simple Spark Transmitter

The "plain aerial" transmitters represented by Fig. 31, also reproduced from last month's article, are not much used at present. In the original forms there were no loading inductance coils *L*, and as a result the groups of waves

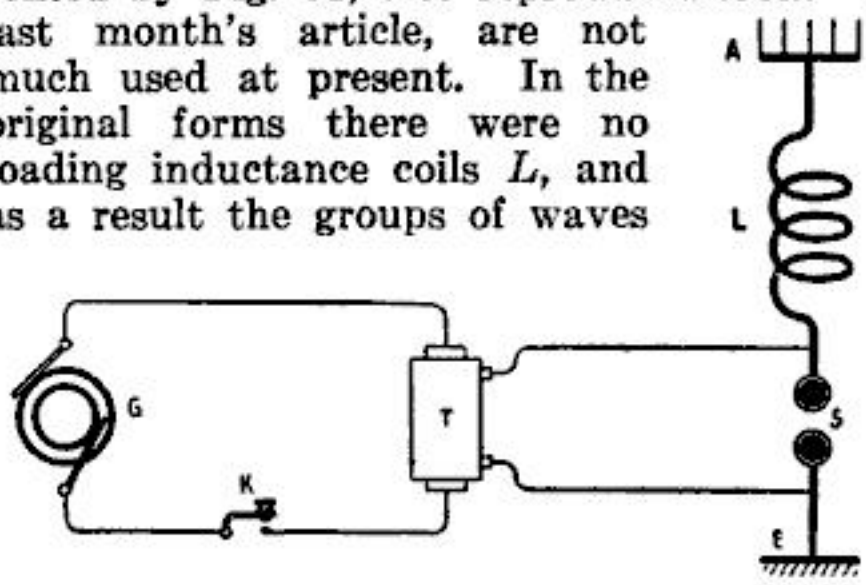


Fig. 31: The plain aerial transmitter is not of a type that is used at the present time

emitted were highly damped (that is to say, died out very quickly) and therefore were not suitable for sharp turning. Even when the loading coil is added to increase the persistence of the wave groups (i. e., to make them die away less rapidly), the various power limitations, as well as the difficulty of securing high electrical efficiency, helped to bring about the disuse of this type of spark transmitter.

The main objection to the "plain antenna" sending arrangement is that the spark-gap itself is directly in series with the antenna-to-ground circuit. Consequently, all the oscillating current of the aerial circuit must pass and re-pass through this gap as it oscillates back and forth between antenna and ground. Since the spark-gap possesses a moderately high resistance, radio frequency energy passing through it is wasted in producing heat. A further objection is that the power available for producing oscillations is limited by the capacity and insulation of the antenna, and that any leakage in the aerial insulators puts a sharp restriction upon the ability to store power before each spark passes and each train (or group) of oscillations starts.

By using the coupled two-circuit transmitter of Fig. 32, these difficulties are overcome wholly or in part. Obviously, the spark gap is no longer in the aerial circuit, and therefore a large portion of the losses due to that arrangement are eliminated. Further, the ability to store power before each spark passes is determined by the capacity and insulation of the secondary condenser *C*, and hence the amount of energy in each oscillation-group is no longer dependent entirely upon the antenna.

All of this will perhaps be made more clear by considering successively the several circuits in the transmitter, both as to their arrangement and operation. Two general arrangements of the power circuits are much used. In the first, there is an alternator located at the radio station and forming part of the radio equipment. This is the usual practice in commercial stations. The second arrangement has alternating current power furnished over long lines from a distant central power station, in which case the alternator supplies a general lighting and power load, and is not strictly a part of the radio outfit.

The Power Circuits

Since the vast majority of commercial stations, and nearly (if not quite) all military and naval plants, have special radio generators at the transmitting points, this type should be taken up first. It is of little importance how the al-

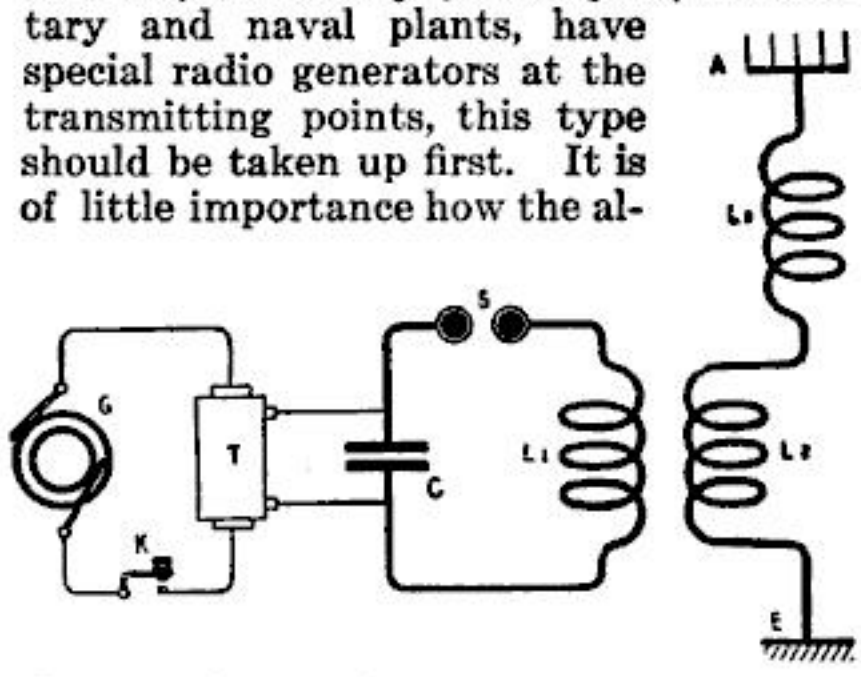


Fig. 32: The coupled two-circuit transmitter overcomes difficulties from the plain antenna

ternating current generator is driven. An electric motor on the same shaft is the most common arrangement, but sometimes steam turbines or gasoline engines, or even geared hand-drives, are used. In every case, some mechanical power is provided for the purpose of rotating the moving part of the alternator, and alternating current of the voltage and fre-

quency desired is delivered from the armature terminals of the machine.

Let us consider a typical spark-sender installation such as is used aboard ship and at many land stations. Direct current electric power is provided from the engine room (or by a public service corporation), and wired to the radio station. Here it passes to a control switchboard and a motor-starter, which is associated with the direct-current motor used to drive the alternating current generator for the radio transmitter. In Fig. 33 the power circuits of such an installation are shown, reduced to their simplest form. The direct current line comes in at L_1 and L_2, and usually operates at a voltage of 110 or 120. As shown in the diagram, the lines lead directly to two fuse-wires W_1 W_2, which serve to protect the apparatus by "blowing" or melting in case too much current is drawn from the line (by reason of a short-circuit or other abnormal condition). From the fuses, the connection runs to a double-pole line switch *LS*, which is used to disconnect the entire motor circuit when the plant is not running. The motor is usually stopped by pulling this switch open. When the switch is closed, the power is applied across the terminals of a voltmeter *VM*, which will always show the voltage of the direct current line if the fuses are in good condition and if the circuits are all right up to this point. From the voltmeter the

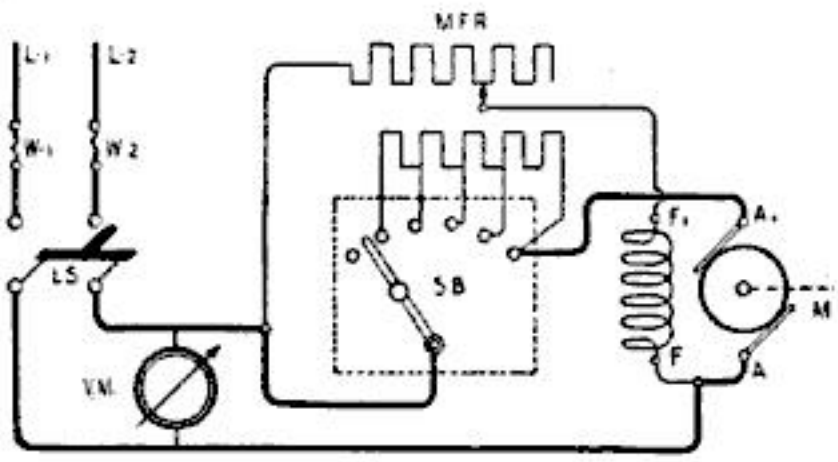


Fig. 33: In most modern installations an automatic electrically-controlled starter is used

wires run to the motor itself, shown at the right of the diagram Fig. 33, passing through a motor field rheostat *MFR* and a starting box *SB*. The starting box illustrated is of the simple hand-controlled type. In most modern installations an automatic, electrically-controlled starter is used, but the principle is the same.

Connections of the Motor

It will be noted that the motor is shown with two field terminals marked *F* and F_1 and two armature connections *A* and A_1. The armature connections

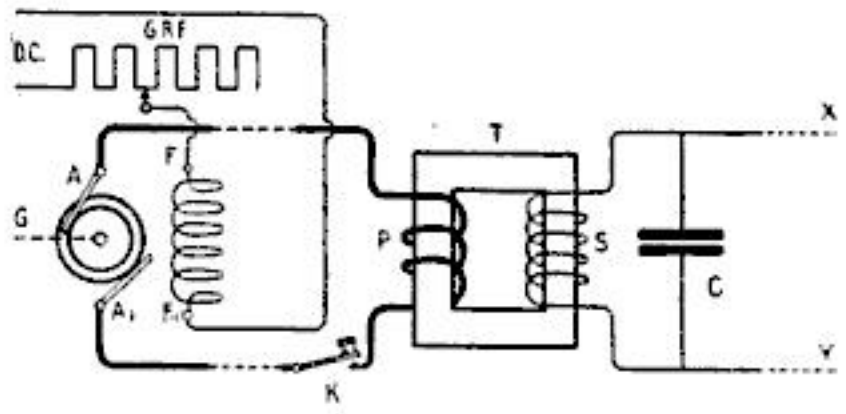


Fig. 34: In addition to the generator itself the circuits of the transmitter are shown

lead to the brushes, as shown, and current applied to them reaches the low resistance armature windings through the rotating commutator. The field is a high resistance stationary winding connected directly across the direct current line through the terminals *F* F_1. It is often called "shunt field" to distinguish it from a low resistance winding called the "series field" which is sometimes used, on compound-wound motors, in series with the armature. One terminal of the field and one of the armature are usually brought together at a "common" point, as illustrated by *A F* in the figure.

The starting box *SB* contains a variable resistance which is connected in series with the low-resistance armature windings. As the contact arm is pulled over slowly, less and less of the resistance remains in the circuit, and the motor turns over faster and faster until (when the line is directly across the armature and all the starting resistance is cut out) full speed is reached. On most starting boxes the contact arm is provided with a spring tending to hold it in the initial or high-resistance position, and a small retaining-magnet which keeps it in the running position so long as the line voltage is normally high. If the current is cut off by opening the line switch, *LS*, or through an interruption of the power circuit outside the radio station, this retaining magnet (often called a "no-voltage release") will let go, the spring

will pull the contact arm back to the starting position and the motor will not only stop but will be protected against the large surge of current which would flow if, when the motor was not revolving, the full voltage were applied across the armature with no starting series resistance.

With the motor brought to full speed by cutting out the starting resistance, the revolutions per minute may be adjusted by use of the motor field rheostat *MFR*. When this resistance is all cut out, the maximum current flows through the field, and the motor revolves most slowly. Conversely, by cutting in more of the field resistance the motor field current is reduced, the field is weakened, and the motor speeds up. If the field is made too weak, the motor will lose power, and though it will run at very high speed when no mechanical load is thrown on it, the speed will be much reduced under load and the operation will be unsatisfactory. Thus it is evident that too much field resistance cannot be used. For a reasonable range, however, the speed may be raised by increasing the resistance in the motor field circuit.

The Generator Circuit

This brings us to the generator *G* of Fig. 34. The generator is usually mounted upon the same shaft as the motor, as is indicated by the dashed line extending to the right from Fig. 33, and to the left from Fig. 34. Of course the two machines then turn at the same speed, and changing the motor speed by use of the motor field rheostat alters the generator speed correspondingly.

The generator, like the motor, has two windings; one is for the field and has its terminals marked F F_1, the other is the armature with connections A A_1 in Fig. 34. In the generator, however, there is no common terminal; the field windings carry direct current supplied from the *DC* line through the generator field rheostat *GFR*, and the armature windings produce the alternating current which is used in the radio transmitter. The frequency of this output of alternating current is determined by the speed of the generator, and may be reduced by slowing down the motor through the motor field rheostat. The voltage of the alternating current, which may be measured by connecting an A.C. voltmeter across the armature at A A_1, is varied by changing the strength of the generator field; the stronger the magnetic field, i. e., the less resistance in the rheostat *GFR*. Hence the greater the field current, the higher the alternating voltage at A A_1.

Adjustment of Frequency and Voltage

In addition to the generator itself, Fig. 34 shows the power circuits of the two circuit spark transmitter of Fig. 32, or, in fact, of any sender which uses alternating current to charge a condenser. The armature or output terminals of the alternating current generator *G* are connected through the signaling key *K* to the primary *P* of the transformer *T*. The secondary *S* of the transformer is connected directly across the high-potential condenser *C*, which in turn may discharge through the wires *X* *Y* to a spark-gap and inductance coil which are not shown in the figure. By varying the two field rheostats, alternating currents of any frequency and voltage within the range of the apparatus may be applied to the condenser *C*. The desirability of having such adjustments available will appear when their effects are described in later articles.

In some coastal commercial radio stations, and in most amateur plants, the alternating current is supplied from a central public service station at a distance. This makes it difficult to adjust the power circuits so as to give the best operation under the most efficient conditions, since the frequency cannot be changed and it is hard even to alter the voltage. When power is supplied in this way, and is used without conversion through rotating machinery (which gives a special and controllable generator at the wireless plant), the line conditions usually vary so much from moment to moment that it is not practicable to maintain the rather critical adjustments which give the best results. Consequently, the motor-generator installation is much to be preferred.

In the next few articles the action of the high voltage and radio frequency circuits, as well as several types of spark gap, will be explained.

(To be continued.)

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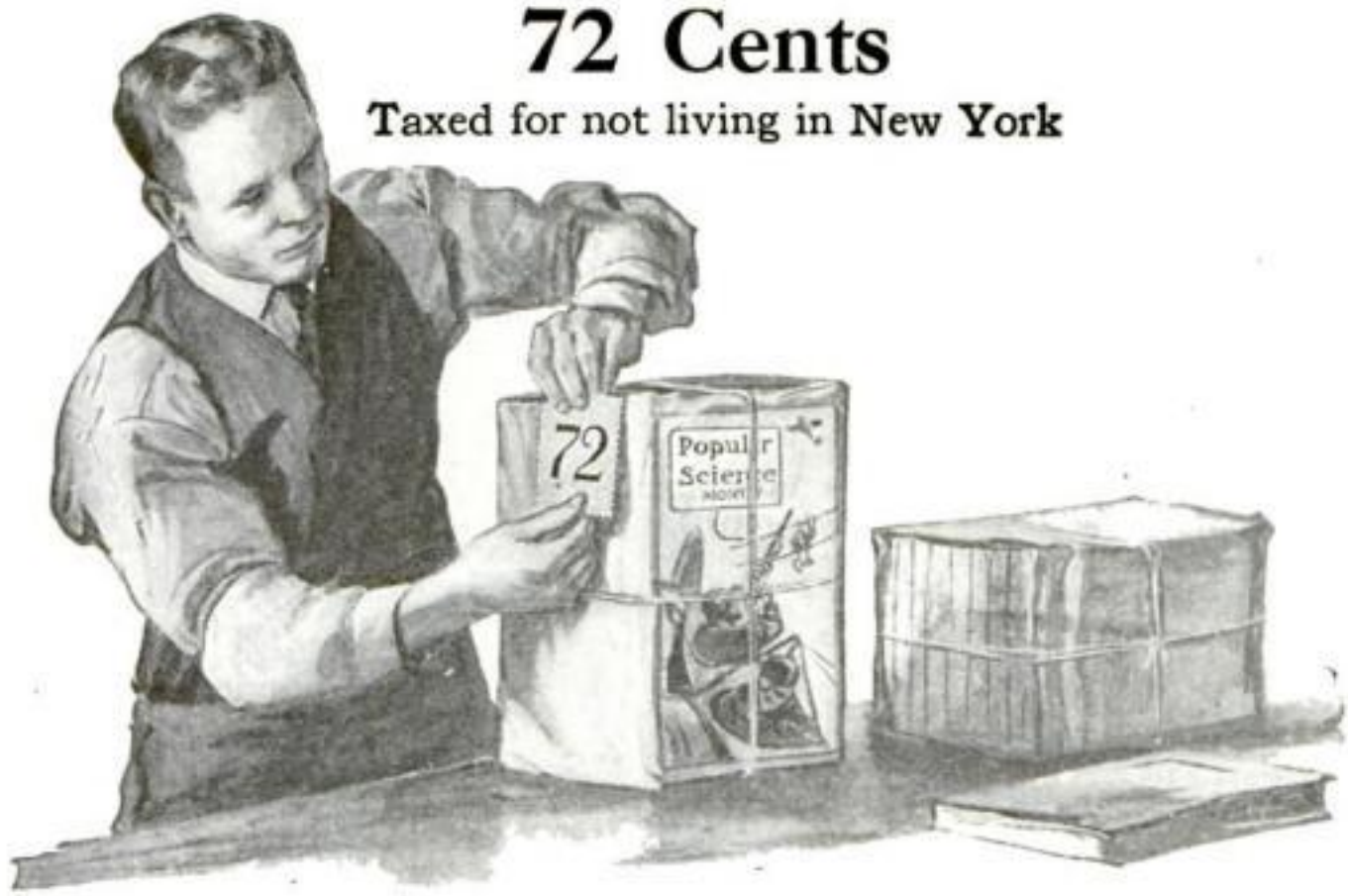

Unless you help to repeal the oppressive Postage Zone Law it will penalize a subscriber in California to the extent of 72 cents for postage alone on a year's issues of Popular Science Monthly

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You and you alone can prevent the zone system from going into effect. Write to your Congressman and Senator about this. Tell them you object. The Editor of this magazine will be glad to give you their names and any further assistance you may desire.

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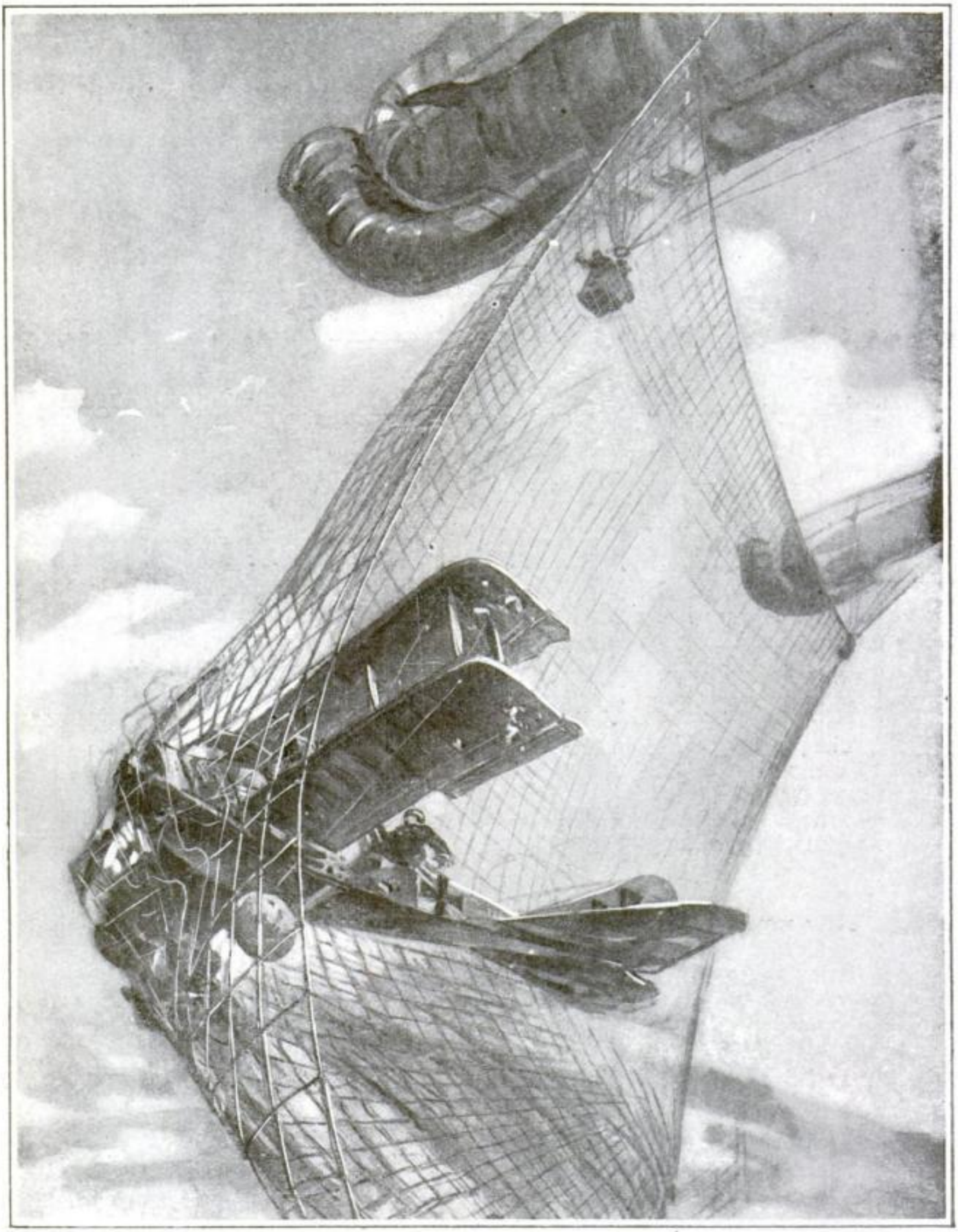

Mr. F. J. Lane, an Englishman, in a letter to the Editor of the *Popular Science Monthly*, proposes the use of nets for trapping raiding enemy airplanes. This could be carried out at night. The nets are to be made of piano wire, and are to be suspended from balloons. The space below would be barred by anti-aircraft guns. The enemy pilot is to be forced into them by pursuing airplanes through open lanes which he will consider avenues of escape. Then a net will loom up before him. It is too late to turn. He must face death either by crashing into the great net or by a hail of machine-gun bullets from his pursuers